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A MANUAL OF DISEASES

OF THE

THROAT AND NOSE

INCLUDING THE

PHARYNX, LARYNX, TRACHEA, ŒSOPHAGUS, NOSE, AND NASO-PHARYNX

BY

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TWO VOLUMES IN ONE

VOL. I.—DISEASES OF THE PHARYNX, LARYNX, AND TRACHEA

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PREFACE.

This work is based partly on the courses of lectures which I have annually delivered at the London Hospital Medical College during the last twelve years, and partly on my essay on "Diseases of the Larynx," to which the Jacksonian Prize was awarded by the Royal College of Surgeons of England. Some of my lectures have appeared in the *British Medical Journal*, *Lancet*, and *Medical Times and Gazette*, but by far the larger portion of the matter contained in these pages is now published for the first time.

The classification of disease is always attended with considerable difficulty, and at present no single system can be rigidly adhered to. For even accepting pathology as the basis, the tissues themselves are of so composite a character, and there are so many "organs within organs" in the human frame, that logical precision cannot be maintained, except by pedantic subdivisions, which would defeat the object of the arrangement. Again, whilst some throat affections are strictly circumscribed in their ravages, others attack different sections of the air-passages at the same time. Hence, although this work has been divided into certain primary sections, and as a rule each disease has been separately considered in its proper division; yet in some cases it has been found more convenient to depart from this plan, and to treat the morbid phenomena of contiguous parts together.

The system of nomenclature issued by the Royal College of Physicians has been adopted with such modifications and additions as the consideration of a special class of diseases rendered necessary.

Records of cases have, as a rule, only been introduced where they

were required for the illustration of a difficult subject, or where the cases themselves were exceptionally rare.

The views which I entertain as regards the use of mercury in syphilis will probably meet with some opposition, but having followed Professor Sigmund's practice in Vienna in 1859 and 1860, I became well acquainted with his views at an early period of my medical career, and a somewhat extensive experience in dealing with the constitutional phenomena of syphilis has since convinced me of the truth of the fundamental views entertained by the eminent Viennese Professor, viz.:—(1) That specific anti-syphilitic treatment is only required when serious constitutional symptoms are present; (2) that specific treatment in the early stages does not ward off the later manifestations of the affection; (3) that local treatment, analeptic remedies, and hygienic measures are of the utmost importance; (4) that the disease itself, except under unfavorable circumstances, tends toward spontaneous cure; and (5) that the development of serious pathological changes depends on conditions inherent in the patient himself. These views have been sustained by Professor Sigmund with all his old energy in the recent edition of his well known "Vorlesungen über neuere Behandlungsweisen der Syphilis." It will, I hope, be understood that whilst employing iodide of potassium more frequently, I nevertheless consider mercury a valuable, and in some cases an indispensable, remedy in syphilis.

Whilst placing the results of my own experience before the profession, I have endeavored to do full justice to the many physicians, both ancient and modern, who have elucidated the class of affections herein discussed; and if, in any case, I have failed to acknowledge the labors of others, I trust that the error will be looked upon as accidental.

I am indebted to many distinguished authors for kindly forwarding me their valuable works and new editions, and I much regret that I was only able to make use of some of them for a few casual references, in consequence of their not having reached me until the greater part of this volume was already in type. This remark especially applies to the second edition of Dr. Solis Cohen's excellent work on "Diseases of the Throat and Nasal Passages," and to the second (Ger-

man) edition of Prof. Ziemssen's able contribution on the "Krankheiten des Kehlkopfes" to his own Encyclopædia; it applies also to Dr. Max Schüller's exhaustive article in the "Deutsche Chirurgie," entitled "Tracheotomie, Laryngotomie, und Exstirpation des Kehlkopfes," and to Prof. Stoerk's comprehensive treatise in the same series on the "Krankheiten des Kehlkopfes, der Nase, und des Rachens." For the reason stated above I have also been obliged to forego the satisfaction of even referring to many other smaller works, to which I hope to do justice on a future occasion.

Incomplete as the work is in many respects, yet, owing to my numerous professional engagements, I could not have collected the materials on which it is founded had it not been for the assistance I have received from many friends. It would be difficult to assign to each the due amount of my obligations, and I must therefore content myself by thanking them collectively. There are a few, however, whose names cannot be altogether omitted. Thus, I am especially indebted to my colleague, Dr. Semon, who has prepared a German translation of this work (to appear simultaneously with the English edition), for many important suggestions and much keen criticism; I have to thank my former assistant, Dr. Gordon Holmes, for valuable aid in matters of historical research, more particularly in connection with those authors whose observations are recorded in the classical languages; and I am very grateful to Mr. Mark Hovel, Resident Medical Officer and Registrar to the Hospital for Diseases of the Throat and Chest, for preparing a detailed index.

M. M.

19 Harley Street, London,
May, 1880.

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DISEASES

OF THE

PHARYNX, LARYNX, AND TRACHEA.

SECTION I.—THE PHARYNX.

ANATOMY OF THE PHARYNX.

The pharynx is that portion of the alimentary tube which corresponds in extent to the interval between the basilar process of the occipital bone above and the interval between the fourth and fifth cervical vertebræ below. It is continuous below with the œsophagus and larynx, in front with the nasal and oral cavities, and above with the ear. It may be described as an irregularly flattened cylinder, wider above than below, and slightly concave anteriorly, applied to the anterior surface of the vertebræ. Its roof, which lies immediately below the skull, is quadrilateral, with rounded edges. It is concave in an antero-posterior direction, directly continuous with its posterior wall, and in form, may not inaptly be compared to the hood of a carriage. The pharynx is freely movable over the cervical spine, and thus permits the various movements which take place in swallowing and respiration. It is in relation with the following structures: posteriorly, with the pre-vertebral muscles, which are covered by a strong aponeurosis, and from which it is separated by the retro-pharyngeal cellular tissue; laterally, with the carotids, the internal jugular veins, the eighth pair of nerves, the sympathetic nerve, and a chain of lymphatics and ganglia; anteriorly, with the nasal fossæ, soft palate, isthmus of the fauces, dorsum of tongue, and posterior aspect of the larynx. The maximum length of the pharynx in the adult is about five inches, and its superior transverse diameter about one inch and three-fifths. It is slightly wider opposite the cornua of the hyoid bone, and opposite the cricoid cartilage it again becomes contracted. Its diameter, in an antero-posterior direction, is about four-fifths of an inch superiorly. Below, its anterior and posterior surfaces are in contact in the centre. Its osseous relations are: superiorly, the basilar portion of the occipital, and the body of the sphenoid, bone, and the so-called basilar fibro-cartilage; anteriorly and above, the vomer in the mesial line; laterally, the internal

pterygoid plates of the sphenoid bone; below, the horizontal plates of the palate bone; and posteriorly, the anterior surface of the five upper cervical vertebræ, with their fibro-cartilages.

The pharynx consists essentially of a fibrous framework, lined by mucous membrane, and containing a complex muscular layer, with blood-vessels and nerves. These elements will be described in the order they are met with in actual examination, a general idea of the inner aspect of the cavity being first given.

For convenience of description, the pharynx may be regarded as consisting of a pharyngo-nasal, a pharyngo-oral, and a pharyngo-laryngeal cavity. The former is concerned in respiration and in the modification of the tone of the voice; the second and third, in both respiration and deglutition.

The pharyngo-nasal space is continuous anteriorly with the nasal cavities, and laterally communicates by means of the Eustachian tube with the middle ear. The upper wall or roof, already described, is rich in gland tissue, and shows numerous depressions and crypts. In some subjects there is a cavity of considerable depth situated posteriorly and in the centre of the roof, in which are found the openings of numerous follicles. This collection of follicles has been described by Luschka[1] as an aggregated acinous gland, and named the "pharyngeal tonsil," in contradistinction to the analogous glands in the fauces. This tonsil is about a centimetre in thickness, and is situated near the vault of the pharynx, between the orifices of the two Eustachian tubes. It is covered with the ciliated epithelium found in this portion of the cavity. The gland is composed of follicles more or less compactly united, and its surface is dotted by a number of small prominences—the openings of the glandulæ. The pharyngeal tonsil is not enclosed within a proper capsule, the reticular connective tissue of the gland being continuous with that of the adjacent mucous membrane. According to Tortual[2] there is a deepish sinus at the anterior border of the roof, which he calls the sinus faucium superior; it extends forward from the semilunar fold of mucous membrane at the border of the posterior nares, externally and below the upper edge of the orifice of the Eustachian tube. The lateral walls of this cavity are limited superiorly by the openings of the Eustachian tubes and the recessus pharyngeus, or fossa of Rosenmüller. The opening of the cartilaginous portion of the Eustachian tube lies on the level of the posterior nares, and is about one-fifth of an inch below the base of the skull, and about three inches and one-fifth from the anterior nares. The aperture is about two-fifths of an inch in its vertical, and about one-fifth in its transverse, diameter. That portion of it which appears in the pharynx is covered by mucous membrane, and is seen as a somewhat rounded elevation, with its convexity turned upward and backward; from its upper extremity a fold of mucous membrane extends to the border of the posterior nares, and from its posterior extremity another fold extends to the hinder surface of the velum pendulum palati. Between the orifice of the Eustachian tube and the posterior wall of the pharynx is a somewhat triangular shaped depression, covered with numerous glands, which is known as Rosenmüller's fossa. The posterior wall of this portion of the pharynx is almost vertical, and lies in front of the pharyngeal fascia, the anterior arch of the atlas, and the body of the axis. Its mucous surface is smooth,

[1] Der Schlundkopf des Menschen, Tübingen, 1868, p. 110.
[2] Luschka: Op. cit. p. 18.

and shows the openings of numerous acini. The anterior wall presents the choanæ, separated by the septum narium, and below them the posterior surface of the soft palate (vide p. 5).

The pharyngo-oral cavity may be said to be limited superiorly by the level of the base of the uvula, and below by a plane passing through the posterior extremities of the greater cornua of the hyoid bone. The posterior surface of the uvula must be regarded as its incomplete anterior wall, the pillars of the fauces its lateral walls, and the base of the tongue, together with the folds of mucous membrane enclosing some muscular tissue, and known as the pharyngo-epiglottic folds, its lower margin.

The pharyngo-laryngeal cavity occupies the position corresponding with the hyoid bone above and the inferior border of the cricoid cartilage below. On its anterior surface, running obliquely downward and slightly forward, is the upper portion of the glosso-epiglottic fold on each side; in the middle, is the epiglottis; whilst the lower border of the cricoid cartilage may be regarded as its inferior limit. The posterior wall of this portion of the pharynx is channelled out, and not flat as in the upper regions. Its anterior wall is wanting centrally, owing to the opening of the larynx. Laterally, the anterior wall of this portion of the pharynx presents a fossa on each side, the pharyngo-laryngeal sinus, which is about half an inch in its antero-posterior diameter and somewhat broader laterally.

The pharyngeal walls average about one-tenth of an inch in thickness, and are formed of mucous membrane and glands, muscles, fibrous tissue, blood-vessels, lymphatics, and nerves.

The mucous membrane is applied to the entire internal surface of the pharynx, and is continuous with all the openings into it; it is slightly adherent to the underlying tissues in the upper portion, but below, in the laryngeal region, it becomes very lax. The structure of the mucous membrane is partly fibrous tissue and partly connective, varying with its position, in the greater part of the pharyngo-nasal cavity. Lower down it is denser than above, and contains an abundance of glandulæ. The epithelium in the pharyngo-nasal cavity, the surface of which is of a pale rose color, is cylindrical and ciliated, whilst in the pharyngo-oral region and below it is tesselated, and somewhat redder.

The glands are of two kinds, conglomerate and follicular. In the pharyngo-nasal cavity the former are most abundant, particularly at the posterior border of the Eustachian tubes and on the pharyngeal surface of the velum pendulum palati, where they are clustered together. They are more sparsely distributed lower down. The follicular glands are found in the pharyngo-oral cavity, and in the roof of the pharyngo-nasal cavity they are collected together and form "Luschka's tonsil," already described.

The fibrous structure of the pharynx forms a complete investment, and serves to maintain its form. It is very tough and strong, and has the fibres of the several muscles attached to it. It is attached superiorly and centrally to the basilar process of the occipital bone through the intervention of the cranio-pharyngeal ligament, and laterally to the petrous portions of the temporal bones, hanging suspended as it were from these points. Its internal surface is covered by the pharyngeal mucous membrane, whilst its external surface supports the muscles of the pharynx. Below it becomes continuous with the cellular tissue of the œsophagus. Laterally, it is attached to the posterior border of the internal pterygoid plate of the sphenoid bone, to the pterygo-maxillary ligament, the poste-

rior portion of the mylo-hyoid ridge, the stylo-hyoid ligament, the cornua of the hyoid bone, the thyro-hyoid membrane, and the posterior border of the thyroid, and the external surface of the cricoid cartilage.

The muscles of the pharynx consist of the three pairs of constrictors: the superior, middle, and inferior, which are arranged in layers, and the stylo-pharyngei.

The superior constrictors are flat quadrilateral muscles, the fibres of which are parallel to each other and directed horizontally. Their fixed insertion is to the lower portion of the internal pterygoid plate, the aponeurosis of the soft palate, the pterygo-maxillary ligament, and posterior portion of the mylo-hyoid ridge, and slightly to the side of the tongue. Their movable attachment is to the median raphé, where some of the fibres of the muscles interlace. The muscular fibres from the internal pterygoid plate pass obliquely upward to the median raphé at the base of the skull, forming a kind of festoon on either side of the middle line; the interspace is filled in by the pharyngeal aponeurosis and the mucous membrane (sinus of Morgagni). The middle constrictors lie in a plane posterior to the superior constrictors, their fixed attachments being to the greater and lesser cornua of the hyoid bone; from these the fibres pass backward in the shape of a fan, the superior ones passing upward and inward and covering the superior constrictor, the middle passing transversely, and the inferior downward and inward. They are ultimately partly inserted in the median raphé, and partly into the pharyngeal aponeurosis—interlacing with each other. The inferior constrictors lie in a plane posterior to the middle, and have as their fixed attachments, anteriorly, the posterior border of the thyroid cartilage and the triangular surface on its outer wall, and the sides of the cricoid cartilage; from these points the fibres pass backward, the inferior horizontally, and the superior upward and inward. In the middle line the fibres are inserted into the pharyngeal aponeurosis, interlacing with one another, and with the inferior fibres of the middle constrictor. The stylo-pharyngei are long, delicate muscles arising from the bases of the styloid processes, and passing downward, forward, and inward; the fibres expand and become inserted into the posterior border of the thyroid cartilage. At first this muscle is applied to the outer surfaces of the superior constrictor, but passing between the inner surface of the middle constrictor and the pharyngeal aponeurosis, it spreads out before it is inserted. These muscles are covered on their outer surfaces by the external fascia, which in the lower two-thirds of the pharynx is derived from the deep cervical, and at the upper third from the bucco-pharyngeal, fascia; whilst internally the fascia applied to them is the cephalo-pharyngeal, which is attached to the fibro-cartilage at the base of the skull.

The arteries are: the ascending pharyngeal from the external carotid, which supplies the chief portion of the region and the Eustachian tube; and anteriorly and laterally, behind and above the openings of the choanæ, some terminal twigs of the internal maxillary, the vidian, and spheno-palatine, which inosculate freely with each other. The veins are collected into a dense plexus in the deeper layers, and terminate in the internal jugular. The lymphatics form a network in the mucous membrane, and also in the muscular structures, and terminate in glands situated at the base of the skull and near the greater cornua of the hyoid bone. (Luschka.)

The nerves are derived from the second division of the fifth, which supplies the roof and orifice of the Eustachian tube, and from some twigs

of the third division, which, however, more particularly pass to the soft palate. The glosso-pharyngeal nerve supplies the stylo-pharyngeus, the superior and middle constrictors, and the mucous membrane. The pharyngeal branches of the vagus, and glosso-pharyngeus, and the spinal accessory, communicate and supply the upper and middle constrictors and the mucous membrane (Hyrtl and Rüdinger), whilst the superior laryngeal supplies the superior constrictor. The sympathetic nerves are derived from the superior cervical and middle cervical ganglia.

The Soft Palate.

The soft palate is a movable curtain continued backward from the hard palate. It has two surfaces of mucous membrane, a posterior, continuous with that of the nasal cavity, and an anterior, continuous with the lining membrane of the mouth. Between these mucous surfaces is a stratum of muscular tissue. The soft palate (or velum pendulum palati) has the uvula in the centre, and laterally the pillars of the fauces, enclosing the tonsil. Its direction is obliquely backward and downward, as regards the hard palate. It is variable in thickness, averaging from one-fifth of an inch to about half an inch; its depth varies from an inch to an inch and a half, and from its crescentic shape it is deeper in the centre than at the sides. Between the pillars of the fauces laterally, the margin of the velum above, and the root of the tongue below, is an opening, capable of many and varied movements—the isthmus of the fauces.

The anterior surface of the soft palate, which forms a portion of the mouth, presents on each side a sharp-edged free margin, springing from the base of the uvula, and curving downward to the tongue, constituting the anterior pillar of the fauces. The mucous membrane on this anterior aspect has a smooth surface, and contains a stratum of acini closely packed together and continuous with those of the hard palate. In its mesial line is a vertical raphé—the indication of the fusion of the sides during embryonic life. Its posterior surface constitutes a portion of the anterior wall of the pharynx, and is formed also by two sickle-shaped processes or folds, whose margins diverge from the uvula as on the anterior surface, but they are thicker and their edges more rounded. Their upper extremities commence at the base of the uvula, and forming smaller arches than those on the anterior surface, pass backward and downward, becoming flatter as they descend, and losing themselves in the lateral walls of the pharynx. The mucous membrane is thickly studded with glands, which form a continuous layer (solitary follicles). The epithelium is of the squamous variety, excepting near the orifices of the Eustachian tubes, where it is ciliated.

The uvula hangs from the centre of the soft palate, as a conical process about a quarter of an inch in length, having the two crescentic folds of the margin of the velum on either side. It is composed of mucous membrane very rich in glands, and contains the azygos uvulæ muscles.

The tonsils lie between the pillars of the fauces, in a sort of niche, bounded internally by the base of the tongue. They are oval glandular masses, generally about as large as a hazel-nut. They are follicular in structure, and, when of normal size, can be just seen when the mouth is wide open, projecting into the isthmus faucium. On the internal surface are a number of mucous crypts, which open by from twelve to sixteen ducts, of varying size, and give the surface of the tonsils the appearance

of almond-nuts. In the spaces between the crypts, and enclosed in the connective tissue, are a quantity of lymphatic glandulæ. The tonsil is in relation externally with the internal pterygoid muscle, and corresponds with the angle of the jaw, or more accurately, the centre of the tonsil corresponds with the posterior alveolar foramen. Posteriorly, are the internal and external carotid arteries, the first about half an inch, and the latter about four-fifths of an inch, from the free surface of the gland, with the internal jugular vein, the vagus and glosso-pharyngeal nerves.

The muscles of the soft palate run in pairs, and under normal conditions act in concert.

The levator palati arises from the apex of the petrous portion of the temporal bone and the inferior cartilaginous portion of the Eustachian tube; the fibres pass downward and inward to be inserted into the superior surface of the velum, interlacing at the middle line. These muscles elevate the soft palate and contract the orifice of the Eustachian tube. The tensor palati arises from the scaphoid fossa and partly from the Eustachian tube. Its fibres pass vertically downward to the hamular process, where the muscle becomes tendinous, and is reflected at a right angle; it is separated from the process by a small bursa. The tendinous fibres expand, and passing transversely inward interlace with the opposite muscle, and become inserted into the inferior surface of the velum. These muscles stretch the soft palate, and during swallowing open the Eustachian tube and admit air to the tympanum. The azygos uvulæ (so called from having formerly been supposed to be a single muscle) arises from the posterior nasal spine and from the posterior portion of the mucous membrane which encloses the uvula; its office is to contract the uvula and draw it backward. The palato-glossus forms the mass of the anterior pillar of the fauces; it is attached superiorly to the aponeurosis of the velum, and below is inserted into the tongue. It is a constrictor of the isthmus. The palato-pharyngeus forms the posterior pillar of the fauces, and arising in the soft palate by fibres connected with those of the opposite side, passes partly above and partly below the levator palati and azygos muscles. After forming the posterior pillar of the fauces the more internal fibres go to the mesial line, and are inserted into the pharyngeal aponeurosis, the middle become lost in the aponeurosis of the velum, and the external pass forward and are inserted into the posterior border of the thyroid cartilage. These muscles contract the isthmus, and, acting with the levatores palati, keep the soft palate horizontal.

The arteries are derived from branches of the external carotid, viz.: the facial, the internal maxillary, and ascending pharyngeal. The pterygo-palatine twig of the internal maxillary and the ascending palatine branch of the facial artery supply the velum, though the latter is more particularly distributed to the mucous membrane, muscles, and glands, the aperture of the Eustachian tube, and its neighborhood. The tonsillar branch of the facial artery supplies the tonsil, the sides of the pharynx, and the root of the tongue. The veins form two plexuses: the posterior, which is associated with the venous system of the nasal mucous membrane; and the anterior, associated with the tongue, and passing into the internal jugular by means of the pharyngeal vein. The lymphatics are arranged, as the veins, in two plexuses, corresponding with those of the nose and root of the tongue; they pass into glands situated at the bifurcation of the common carotid, and in the region of the greater cornu of the hyoid bone.

The motor nerves of the soft palate are: the motor portion of the

lower division of the fifth which supplies the tensor palati through the Otic ganglion; the facial supplying the levator palati and azygos uvulæ through the connection of its trunk with the Vidian by the petrosal nerves, and the palatine branches of Meckel's ganglion which supply the palato-glossus and palato-pharyngeus. The sensory nerves are derived from the second division of the fifth (its nasal ganglion), which supplies the anterior surface of the velum. The glosso-pharyngeal, vagus, and spinal accessory furnish twigs to the lateral and posterior portions of the soft palate and the tonsil. The chorda tympani presides over the secretory functions.

THE EXAMINATION OF THE PHARYNX.

The pharynx is not entirely accessible to direct vision, and the laryngoscope or pharyngoscope (as the instrument has been called when employed to examine the upper part of the throat) is requisite for the inspection of certain parts. Further, from the situation and conformation of the pharynx, some regions can only be investigated by means of probes or by digital exploration.

In making an ordinary examination, it is best to use the large frontal mirror of the laryngoscope. The patient should be directed to open his mouth and take a deep inspiration. The tongue should then be gently pressed down with a spatula, or, better still, with the handle of a laryngeal mirror. Sometimes, however, this organ is so unruly, and the patient so sensitive, that the slightest pressure will produce retching. Under these circumstances a view can often be obtained, without touching the tongue, when the patient inspires deeply; or the tongue may be protruded, and firmly but gently grasped between the thumb and index finger of the operator, enveloped in a towel or napkin. If the patient at the end of a deep inspiration then utters the vowel "*a*," the soft palate and uvula, as well as the pillars of the fauces, will come into view.

The first object which attracts attention is the uvula, which in health is about a quarter of an inch in length, and of a pale red color, like the palpebral conjunctiva. From the margin of the uvula on either side at its base, presenting a crescentic border directed downward, is the free border of the velum, or curtain, of the palate. This free border, when it reaches the side of the pharynx, becomes continuous with the posterior pillar of the fauces. About three-eighths of an inch above the base of the uvula on either side is the inner termination of a second crescentic ridge, which, passing outward, forward, and downward, becomes continuous, at the side of the pharynx, with the anterior pillar of the fauces. Bounded by these pillars or ligaments, anteriorly and posteriorly on each side, are the tonsils, which in health do not project beyond the borders of the pillars. Between the two posterior pillars is the posterior wall of the pharynx, which, in common with all the other parts of this cavity, is lined with mucous membrane. It is a frequent seat of disease, and always deserves a close inspection. In health it is of a deeper red color than the uvula; its surface is smooth and shining, and studded here and there with the minute elevations of the mucous follicles. Small veins and arteries are also seen coursing along its surface—generally taking a vertical, or obliquely vertical, direction.

The inferior portion of the pharynx is situated immediately behind, and partly below, the entrance of the larynx, and it sometimes happens that foreign bodies become impacted in this situation. They still more often become lodged in the pharyngo-laryngeal sinus, a small cavity at the lower part of the pharynx, on each side, bounded externally by the side of the pharynx, and internally by the thyroid cartilage. In some cases the cavity can be inspected with the laryngoscope, but in others it is concealed. Under these circumstances, in young subjects, or in persons with a short neck, the finger can often determine the exact position, and frequently effect the removal of a foreign body. In other cases, probes and forceps have to be employed.

For examining the upper part of the pharynx, a small laryngeal mirror should be used. In this situation, digital examination is, however, also very useful. The mouth being widely opened, the operator can pass his index finger upward behind the soft palate, and the vault of the pharynx and its posterior wall in the upper region, as well as the orifices of the posterior nares and Eustachian tubes, can be thoroughly explored.

PHARYNGEAL INSTRUMENTS.

Probes.—Special probes are not required for the pharynx, those used for the larynx (hereinafter described) answering the purpose perfectly well.

Brushes.—For applying solutions to that part of the pharynx which is visible on direct inspection, a camel's-hair pencil attached to a straight piece of aluminium wire, and fixed in a wooden handle, is all that is required. For applying remedies to the upper and lower part of the pharynx, the ordinary laryngeal brushes (see Laryngeal Instruments) answer every purpose.

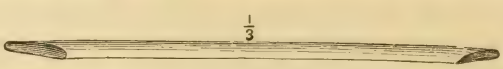

Fig. 1.—The Pharyngeal Spatula.

Fig. 2.—The Pharyngeal Bistoury.

The Spatula.—This instrument (Fig. 1) resembles a long tapering wooden penholder, cut flat at both ends, so as to present a larger and smaller surface for receiving the caustic paste. It should be made of oak, box, or some other hard wood. It is very useful for applying caustic paste in cases of granular pharynx.

The Bistoury.—This knife (Fig. 2) is like an ordinary sharp-pointed bistoury, except that the shank of the instrument should be about five and a half inches long, and only the last quarter of an inch should have a cutting edge. This is the most serviceable instrument for opening abscesses.

Forceps and Scissors.—For removing growths from the pharynx, forceps and scissors are sometimes required. These instruments should be

about eight inches in length. The forceps should have sharp teeth, and the scissors should be slightly curved.

The Pharyngeal Curette.—This instrument (Fig. 3) consists of a sharp loop of metal (somewhat resembling a curry-comb when its two ends are held in the hand), which can be fixed at any angle to its shaft, by means of a ball-joint and lock. It is extremely useful for scraping away the inspissated secretion in cases of follicular disease, especially when the affection occurs at the lower part of the pharynx, or attacks the epiglottis. It may also be used for tearing away adenoid vegetations from the vault of the pharynx.

The Tonsillotome.—Instruments for removing the enlarged tonsil are now very frequently employed, and the manner in which they came into use will be best understood from a short historical retrospect.

When excision of the tonsils became a recognized method of treatment, the aid of mechanics was soon called in to effect an easy and rapid operation. We are indebted to an American surgeon for the first tonsillotome. The idea of this instrument appears to have been derived from the uvulatomes in use in this country at the end of the eighteenth century. Benjamin Bell,[1] in his classical work, described and figured an uvula guil-

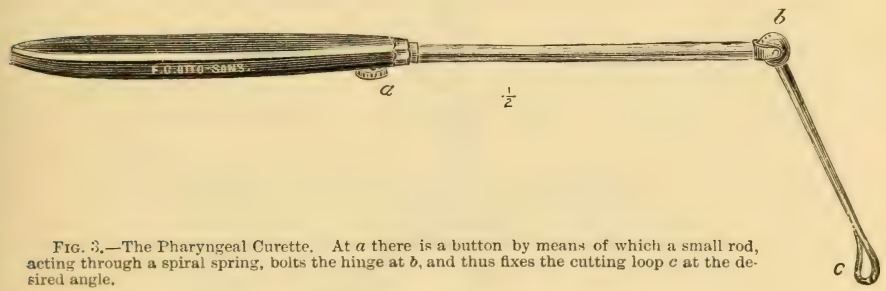

FIG. 3.—The Pharyngeal Curette. At *a* there is a button by means of which a small rod, acting through a spiral spring, bolts the hinge at *b*, and thus fixes the cutting loop *c* at the desired angle.

lotine. It consisted essentially of a flat piece of metal with an elliptical opening at the distal extremity, and a broad semicircular blade, which when pushed forward closed the opening and cut off the uvula.

In the year 1827 Dr. Physick,[2] of Philadelphia, not only improved the uvulatome, but had it made on an enlarged scale, and used it for the tonsils. In modifying the instrument Dr. Physick added the stout handle at its lower part, which greatly facilitated the application of the instrument, and enabled the operator to press it firmly to the side of the throat. Five years after Physick's invention Fahnestock[3] devised and described an instrument for excising the tonsils, which he called a *sector tonsillarum.* This instrument has been largely used in France and Germany, and in-

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[1] System of Surgery, 1783, vol. iv. p. 144, Plate lii. Fig. 1. Bell himself preferred a probe-pointed bistoury curved at the end almost to a semicircle (same page and plate). Whatever instrument was used the uvula was steadily held, and the mouth kept open by a speculum oris or mouth dilator (Plate liv.).

[2] Amer. J. Med. Sci., vol. i. p. 262. Messrs. Tiemann & Co., of New York, state that they manufactured a tonsillotome about the year 1828 or 1829, and, according to a letter lately placed in my hands by Dr. Beverley Robinson of New York, claim to have been the inventors of that instrument.

[3] Amer. J. Med. Sci., 1832, vol. xi. p. 248. Description of an instrument, etc., etc., by Wm. B. Fahnestock, M.D., of Lancaster, Pa.

deed throughout the whole world it is known as Fahnestock's guillotine. Originally it consisted of a canula terminating in a circular ring, guarding a blade of similar shape, with concentric cutting edge. On being placed over the tonsil the cutting ring was withdrawn by means of a handle attached to the canula, and the gland was divided from behind forward. As soon as the instrument became the property of the surgical world it underwent numerous modifications. Guersant [1] altered the shape of the ring from circular to elliptical—a form which is much better adapted to the contour of the tonsil. The same surgeon, on the suggestion of Velpeau, added a small two-pronged fork to the tonsillotome by a

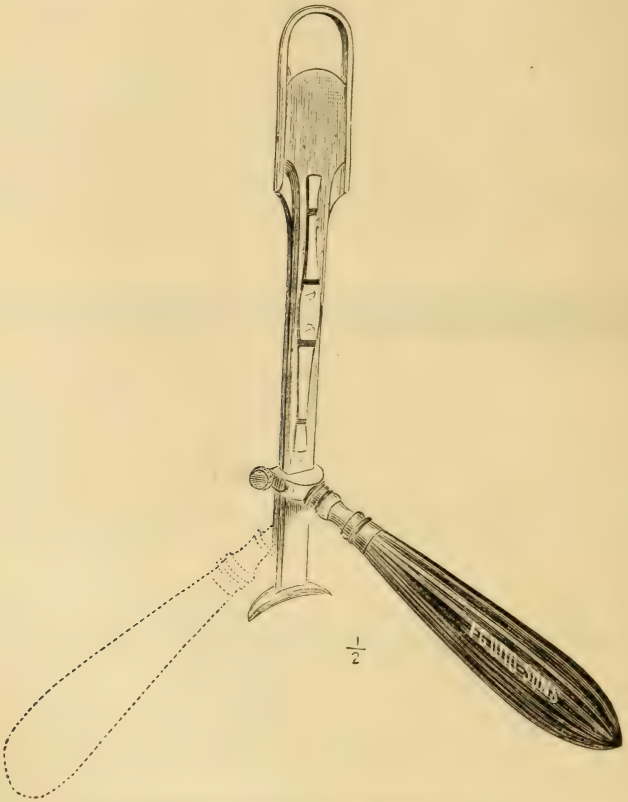

FIG. 4.—Physick's Tonsillotome (modified by the Author).

mechanism which transfixed and drew the tonsil from its bed before subjecting it to the action of the cutting blade. Chassaignac [2] augmented the number of prongs to three, in order that the gland might be seized with greater firmness, and Maisonneuve [3] made further improvements in the instrument.

Though Fahnestock's guillotine is almost universally used, I greatly prefer instruments made on the simple model of Physick, as all complica-

[1] Hypertrophie des Amygdales, Paris, 1864.
[2] Leçons sur l'Hypertrophie des Amygdales, Paris, 1854.
[3] Bull. de la Soc. de Chir.

ted mechanism is thereby avoided, the instrument never breaks, and can always be kept clean and sharp. With Physick's instrument also the operator has much more power in placing the tonsillotome *in situ*. The guillotine which I employ is the same as that of Physick slightly modified —so that the handle can be applied to either side of the shank. This arrangement enables the operator to use the instrument with his right hand for amputating either tonsil, the free surface of the blade in each case being directed toward the centre of the mouth. In operating, the pa-

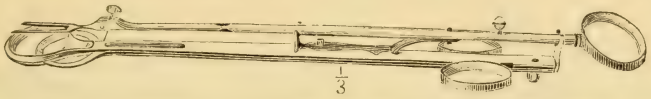

FIG. 5.—Fahnestock's Tonsillotome (as improved by French surgeons).

tient should sit facing the light, and the operator with his back to it. A laryngoscopist, however, will always prefer to illuminate the throat with the frontal mirror. The instrument being ready for use, the hilt is grasped in the right hand, and the aperture in the shank is placed over the tonsil. The surgeon, with the thumb or index finger of the left hand placed under the angle of the patient's jaw, then presses the tonsil inward, whilst at the same moment, with the thumb of his right hand, he drives home the blade of the tonsillotome.

Professor Lucae,[1] of Berlin, has still further modified this instrument by adding a cup-shaped cavity over the extremity—in order to prevent the excised tonsil falling down the throat—and by dispensing with the

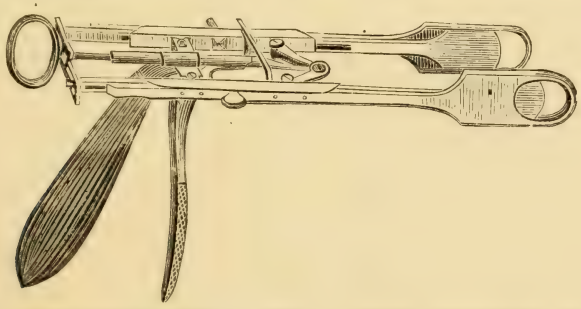

FIG. 6.—The Author's Double Tonsillotome. When the instrument is introduced into the mouth the blades meet in the centre: but on grasping the two handles together, the blades are thrown out against the sides of the throat, and the tonsils received in the oval openings of the tonsillotomes. Amputation is then effected by pressing on the ring at the proximal extremity of the instrument in the ordinary way.

wooden handle. As, however, in using Physick's guillotine the tonsil is always either caught in the instrument or brought forward into the mouth, I do not see the use of Professor Lucae's suggestion for receiving the tonsil. I may add that the wooden handle, dispensed with by Lucae, is one of the most important features in Physick's instrument, as it insures steadiness and gives power. Some years ago Messrs. Mayer & Meltzer made a double guillotine for me (Fig. 6), by means of which both tonsils can be simultaneously excised. The only objection to its use is

[1] Deutsche Medic. Wochenschrift, Nos. 11 and 15, 1877. I am indebted to Mr. Detert, the well-known Berlin instrument maker, for a very perfect specimen of Professor Lucae's guillotine.

that it acts equally on both tonsils, whilst it sometimes happens that more of one tonsil requires to be removed than of the other.

The Uvulatome.—In speaking of tonsillotomes, it has already been shown that this instrument preceded, and, indeed, gave rise to the invention of the tonsillotome. The uvulatomes, however, which were in use in this country at the end of the eighteenth century, were of a very rough construction, and it was only when the introduction of the laryngoscope gave a great impetus to the study of throat affections, that the modern uvulatome was invented. The credit of greatly improving this instrument

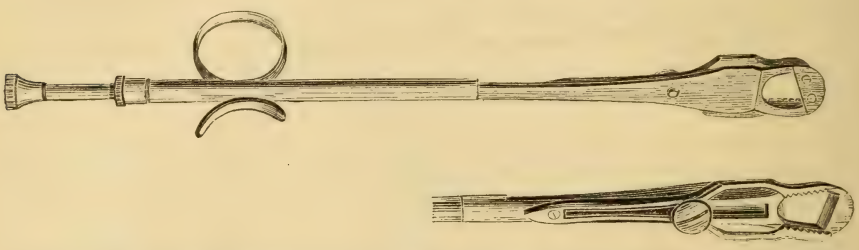

FIG. 7.—The Author's Uvulatome. In the complete instrument the upper surface, with the cutting blade, is shown; whilst in the other drawing the under surface, with the forceps which seize the uvula when cut through, is seen.

is due to Dr. Elsberg, of New York. His instrument consisted of a cutting blade which was drawn back until placed *in situ;* and was then suddenly discharged by touching a trigger in its upper surface. Beneath the blade were forceps, which seized the uvula as it was cut through. Finding, however, that this instrument was inconvenient in practice, as the strong spring imparted a great jerk to the instrument, whilst the blade often failed to cut through the uvula, I abandoned the spring and trigger arrangement and added a second cutting blade. One of the blades is pushed forward by the thumb whilst the other is a fixture at the distal extremity of the instrument. The two blades are arranged at such an angle that they correspond to the blades of a pair of scissors. In other words, as the movable blade passes down over the one that is fixed, the aperture receiving the uvula forms an isosceles triangle until it is obliterated by the complete closure of the blades. In using this instrument, the free surface of the blade should always be directed upward, and it is well to hold it somewhat obliquely, as by this means a tapering, instead of a truncated, uvula results from the operation.

DISEASES OF THE PHARYNX.

CATARRH OF THE PHARYNX.

(Synonyms: Pharyngitis. Sore Throat.)

Latin Eq.—Catarrhus pharyngis. Pharyngitis.
French Eq.—Angine inflammatoire, superficielle, ou catarrhale. Pharyngite.
German Eq.—Schlundkatarrh. Schlundentzündung. Halsweh.[1]
Italian Eq.—Catarro della faringe. Faringitide.

Definition.—Acute inflammation of the mucous membrane of the pharynx, usually terminating in resolution, but in cachectic persons often causing a liability to future attacks, and leading ultimately to relaxation of the mucous membrane of the pharynx.

Etiology.—Catarrh of the pharynx affects all classes, and is common at all ages. It is most frequent, however, in young persons. The strumous diathesis, general feebleness of constitution, and long-continued exposure to any influences which tend to depress the vital powers, such as contaminated air, bad food, impure water, &c., act as predisposing causes of the disease. Persons engaged in sedentary occupations, and dwellers in cities are more subject to the affection than those living an active country life. Catarrh of the pharynx is most prevalent at those seasons of the year when sudden changes of temperature and inclement weather are frequent, and the exciting cause of the malady is generally exposure to cold or damp. Those who have had syphilis, or been mercurialized, are very subject to the affection. Finally, the disease occasionally appears to arise from some peculiar condition of the atmosphere, which seems to engender it epidemically.

Symptoms.—The onset of pharyngeal catarrh is in most cases accompanied by slight feverish symptoms, and a general feeling of lassitude and depression. These phenomena, however, may be almost entirely absent, the first symptom complained of being a disagreeable sensation of dryness, and a stiffness in the throat in swallowing. As the morbid action becomes fully developed, considerable pain may be experienced in deglutition, whilst the voice becomes hoarse and partakes of a nasal

[1] The Germans do not, as a rule, use popular names for the various inflammatory affections of the pharynx, but employ the generic term *angina* for all of them, with a qualifying description of the affection, thus: angina catarrhalis, a. tonsillaris, a. gangrænosa.

timbre. At the same time the patient may suffer from noises in the ears, and the sense of hearing may be temporarily impaired. The character of the symptoms depends on the extent and situation of the inflammation, and some writers have divided the disease into two varieties, namely, superior, and inferior, pharyngitis.[1] When the upper part of the pharynx is attacked, the swallowing and hearing are affected. On the other hand, should the disease be situated in the lower part of the throat, pain is caused by any movement of the larynx, and there is tenderness on pressure at the sides of the neck. When the whole tract of the mucous membrane of the pharynx is inflamed, there is a combination of all the phenomena. In all cases, after the first day or two, there is a considerable increase of the mucous secretion, and the patient resorts to constant efforts of coughing and hacking, in order to clear his throat. As a rule, resolution soon occurs spontaneously, and at the end of a week the parts have regained their normal condition. In very rare cases, however, the disease, which at first seemed a mild catarrh, develops into an active inflammation, or true *pharyngitis*. The symptoms are then greatly intensified. Occasionally, the inflammation extends to the larynx, and the symptoms of the pharyngeal affection are lost in the more serious phenomena of œdema of the glottis. Cases, indeed, have been placed on record by Bamberger,[2] Rilliet and Barthez,[3] and Rühle,[4] which have been thought to show that acute pharyngitis may rapidly prove fatal. In Bamberger's cases, however, as well as in those of Rilliet and Barthez, there was probably suppressed scarlatina, whilst Rühle's patient was also the subject of acute alcoholismus. In feeble persons, after the acute symptoms have passed off, there sometimes remains a persistent delicacy of the mucous membrane of the pharynx, which renders the individual peculiarly susceptible to subsequent attacks of a similar nature. Cases have been reported by Gubler,[5] Broadbent,[6] and others, in which a simple acute inflammation of the pharynx caused subsequent paralysis of the veil of the palate.

On inspecting the pharynx, in a case of ordinary catarrh, the mucous membrane is seen to be of a vivid red color, and to present a dry shining appearance. Some tumefaction of the pillars of the fauces and soft palate is almost always present. Small veins, not visible at other times, may be perceived, and the uvula is often slightly œdematous and elongated. When the pharynx is more acutely affected, the mucous membrane of the posterior wall of the pharynx is swollen and of a bright red color, looking like rich crimson velvet. Sometimes the epiglottis is also seen to be much swollen and congested. When the inflammation is on its decline, the surface of the mucous membrane is often streaked with dark colored viscid mucus, which adheres to the parts with great tenacity.

Diagnosis.—Catarrh of the pharynx may be confounded with quinsy, but as the gland soon begins to swell when it is inflamed, the differentiation of the disease is quickly established.

Pathology.—The affection, when slight, is merely a fluxionary hyperæmia; when severe, an acute inflammation. In all cases the vessels are dilated, and the severity of the affection depends on the amount of sub-

[1] Peter: Dict. des Sc. Méd., Paris, 1864, vol. iv. p. 695.
[2] Handbuch der Pathologie, &c., Erlangen, 1855, Abth. 1. s. 6.
[3] Maladie des Enfants, Paris, 1855, p. 233 et seq.
[4] Volkmann's Sammlung Klin. Vortr., Leipzig, No. 6, s. 9.
[5] Archives Gén. de Méd., 1859-60.
[6] Lancet, 1871, vol. i. p. 308.

mucous infiltration. The secretions contain a number of pus-cells and micrococci.

Prognosis.—The great majority of cases terminate in resolution, and leave no troublesome after-effects. In cachectic persons, however, as already remarked, a permanent weakness of the mucous membrane is often the consequence of catarrhal inflammation, and the individual is rendered liable to repeated attacks of the same kind.

Treatment.—Few persons think it necessary to take medical advice, on account of an ordinary pharyngeal catarrh. Confinement to the house for a day or two, restriction to a light diet, and the avoidance of stimulants, are the only measures required in order to allow the disease to undergo spontaneous resolution. A wet compress, or mustard poultice to the neck, a hot foot-bath, and sucking ice expedite the cure. An opiate, especially the tincture of opium, taken early in the day—if possible, will generally cut short an attack. The stimulating effect of opiates is greatly diminished if the patient sleeps immediately after taking a dose. Hence the old plan of administering Dover's powder just before going to bed does not answer so well as that now recommended. From five to ten drops of laudanum generally produce the best effect. Larger doses act as a sedative, and instead of controlling the vascular action, lead to relaxation. A Turkish bath is a popular remedy, which will also frequently cut short an attack of pharyngeal catarrh. The disappearance of the local affection may, generally, be considerably hastened by prescribing a rhatany lozenge every three or four hours. After the acute symptoms have subsided, the mucous membrane may be braced up by astringent solutions. A few applications of the pigment of chloride of zinc or perchloride of iron (Throat Hosp. Phar.) are especially useful for this purpose.

The disposition to pharyngeal catarrh is best counteracted by the use of a cold bath in the morning, when sufficient reaction follows. The skin should, if possible, be made less sensitive by the use of rough towels and flesh brushes, whilst hot rooms, late hours, and all habits calculated to relax the system, should be strictly avoided.

Uvulitis.

In some cases where the pharynx is inflamed, the violence of the morbid action appears to be expended on the uvula. Under such circumstances this part becomes intensely red, swollen, and elongated, or it may be highly œdematous, and have a pale translucent appearance. It may attain the thickness of one of the fingers, and hang down into the sulcus, between the epiglottis and tongue, or even pass into the larynx and give rise to distressing paroxysms of dyspnœa.

The *treatment* should consist of scarification or amputation. When the œdema is slight, the uvula may be scarified by means of a sharp-pointed bistoury. In a few hours after the operation the part generally returns to its normal size. When, however, the inflammation is very active, scarification sometimes only gives exit to a few drops of blood, and in such cases the best procedure is to amputate the end of the uvula with the uvulatome. A discharge of watery blood at once ensues, which greatly relieves the engorgement both of the uvula and the surrounding parts. Under these circumstances the inflammatory action usually undergoes rapid resolution.

RETRO-PHARYNGEAL ABSCESS.

(Synonyms: Post-Pharyngeal Abscess.)

Latin Eq.—Abscessus post-pharyngeus.
French Eq.—Abcès rétro-pharyngien.
German Eq.—Retro-pharyngeal Abscess.
Italian Eq.—Ascesso retro-faringeo.

Definition.—An inflammatory swelling containing pus in the posterior wall of the pharynx.

Etiology.—This is essentially a disease of childhood, though it occasionally attacks adults. The youngest children may suffer from it, and several cases are reported in which the disease occurred in sucking infants.[1] The male sex does not show the preponderating predisposition to the affection which is seen in many other diseases of the throat. Bokai[2] has collected 144 cases, and of these 78 were boys, and 66 girls. It used to be supposed that the disease was most commonly the result of scarlatina, but Bokai's cases have clearly proved that the affection is generally idiopathic.

The following table, abridged from that author, well illustrates the causes of retro-pharyngeal abscess:—

129 cases were idiopathic,
7 appeared in the course of scarlet fever,
4 were due to cervical spondylitis,
3 were of hypostatic character,
1 was traumatic—due to a foreign body.

In a large number of the idiopathic cases the little patients exhibited a scrofulous diathesis.

In adults, abscesses, not larger than a pea, sometimes form in the wall of the pharynx as the result of catarrh, but these cases do not belong to the class now under consideration.

Symptoms.—The inflammatory process which leads to the formation of an abscess behind the posterior wall of the pharynx is generally of an insidious nature. In most cases the symptoms are not sufficiently prominent to attract attention until the local swelling interferes seriously with respiration and deglutition. On inspection of the pharynx, if the abscess is situated high up, the mucous membrane of the posterior wall can be seen bulging forward, and presenting a red, smooth, and uniform surface—indicative of tension. On passing the finger (which in the case of children, in order to avoid being bitten, should be protected by being partly wrapped in a cloth) into the back of the mouth, a soft tumor can

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[1] See a case by Besserer: Abscess an der hintern Wand des Pharynx bei einem vier Monat alten Kinde. Schmidt's Jahrb., 1845, p. 198; also a case by Winternitz: Retro-pharyngeal Abscess im Säuglings' Alter, Wochenschrift der Gesellschaft der Aerzte in Wien, 1861, p. 241.

[2] Jahrbuch für Kinderheilkunde, 1876, Heft 1 und 2.

be perceived. When the abscess is in the lower part of the pharynx, its presence can be determined with the aid of the laryngoscope.

The symptoms vary somewhat according to the position of the abscess. If the tumor is situated at the upper part of the pharynx, deglutition, especially of solids, is difficult, and the voice partakes of a nasal intonation, but the occlusion of the passage is not usually sufficient to incommode respiration. When the bulging of the pharyngeal wall occurs opposite the larynx suffocative attacks are likely to be frequent and may prove fatal, whilst swallowing may, at the same time, be interfered with to a serious extent. If the abscess occupies the sides of the pharynx there is great danger that the pus may burrow into the cellular tissue of the ary-epiglottic folds and thus produce œdema of the glottis and fatal dyspnœa. In addition to the phenomena consequent on obstruction of the degluto-respiratory canal, there may be stiffness of the neck, or the head may be drawn to one side or thrown backward, owing to extensive infiltration of the areolar tissue between the pharynx and vertebral column. Bokai considers that the position of the head affords a valuable diagnostic sign. When the abscess is situated laterally, as occurs in three-fourths of the cases, the head is inclined toward the healthy side. In some cases tumefaction of the lateral and posterior parts of the neck may be present, whilst contraction of the sterno-mastoid muscle may be so marked as to give the idea of tetanic spasm. During the first years of life, convulsions almost constantly accompany the disease, and Bokai observed facial paralysis in three cases. There is seldom, however, any fever in children. The symptoms of post-pharyngeal abscess often exhibit a remarkable resemblance to the phenomena of croup, for which disease I have known pharyngeal abscess to be mistaken on several occasions. In the majority of cases, a sudden termination of all the symptoms is brought about by the spontaneous bursting of the abscess, but in some instances the quantity of pus is so great as to suffocate the patient in its sudden evacuation.[1] Wendt [2] states that the abscess, when left to itself, may give rise to fistulous tracks which extend in the direction of the thoracic cavity or in the skin of the neck.

According to Bokai, whilst idiopathic abscesses form rapidly—often in two days—secondary abscesses require a week or more for their development. Abscesses proceeding from disease of bones are still more chronic in their course. In conclusion, it may be observed that should the abscess depend upon caries of the vertebral column, the fact can generally be ascertained by noting whether pain is caused by pressure on the spinous processes of the cervical vertebræ.

Diagnosis.—Retro-pharyngeal abscess may be confounded with croup, with a foreign body in the larynx, or with œdema of the glottis. With respect to croup, the diagnosis can easily be established by attention to the condition of the vocal and deglutory functions in the two diseases. Thus, in croup, the voice is soon extinguished, whereas in post-pharyngeal abscess, it is usually only altered in intonation. Again, in croup there is no dysphagia, whereas in retro-pharyngeal abscess difficulty of swallowing is as prominent a symptom as dyspnœa. In addition, portions of false membrane being frequently coughed up in the croupous affection, the diagnosis may often be established from the appearance of the expectoration. The physical examination of the throat, when possi-

[1] See a case by Gaupp: Wurtemb. Corr. Bl. xl. No. 23, 1870.
[2] Ziemssen's Cyclopædia, vol. vii. p. 68.

ble, will of course determine the nature of the disease. As regards a foreign body in the larynx, its presence may evoke symptoms similar to those of retro-pharyngeal abscess, but phonation is generally more troubled than in the latter affection. The history of the case, and the use of the laryngoscope, will, in many instances, complete the evidence as to the impaction of a foreign body in the larynx. On reference to the symptomatology of retro-pharyngeal abscess, it will be seen that a veritable œdema of the glottis sometimes occurs through extension of inflammation, or purulent infiltration, to the ary-epiglottic folds. The phenomena of the two maladies are thus occasionally combined.

Pathology.—The origin of these abscesses is probably to be found in the structure of the part attacked. The abundance of glandulæ in this situation has long been recognized, and the peculiar arrangement of the lymphatic vessels, as described by Dr. Edmund Simon[1] is still more remarkable. These conditions provide the nidus for the development of scrofulous inflammation, which is so likely to occur in young children predisposed to the disease by diathesis. The occurrence of abscess in cases of spondylitis is only in accordance with the phenomena commonly observed in inflammation of the osseous structures and their protecting periosteum.

Prognosis.—A favorable termination may generally be anticipated when the abscess is diagnosed early and a free exit given to the pus. Spontaneous evacuation of the matter is also commonly followed by an immediate amelioration of all the symptoms. The prognosis is most unfavorable where the abscess has been allowed to interfere with deglutition and respiration for so long a time as to produce slow asphyxia and marasmus. In those cases where the disease is connected with caries of the vertebræ, the presence of a constitutional dyscrasia, and the impossibility of removing the cause of the affection, render the prospect of recovery less hopeful. Mr. Syme,[2] however, has reported a case in which recovery took place after the exfoliation of the greater part of the second cervical vertebræ; and Günther[3] relates a still more remarkable instance in which the patient recovered after the removal of the third and fourth cervical vertebræ. Both these cases were probably syphilitic. In cases of spondylitis the malady pursues a tedious course, which exhausts the vital powers, and the abscess, if opened, is not unlikely to fill again.[4] As already pointed out, the sudden rupture of a large retro-pharyngeal abscess may give rise to immediate suffocation, and it must not be forgotten, as already pointed out, that, in infants, the formation of the pus is sometimes accompanied with convulsions. The prognosis may be gathered from a consideration of Bokai's cases.[5] The idiopathic cases are the least fatal, for out of 129 cases only 5 proved fatal. Of the 7 patients with scarlet fever 2 died, and of the 4 cases of cervical spondylitis 3 terminated fatally. The traumatic case also resulted in death.

Treatment.—If pus has not actually formed, the case should be treated by ice, both externally and internally. If suppuration has occurred,

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[1] Schmidt's Jahrbuch, vol. cvii. p. 161.

[2] Edin. Med. Journ., April, 1826, p. 311.

[3] Deutsche Klinik, 1856, p. 34. (Both this reference as well as the last one are given by Dr. Solis Cohen: Diseases of the Throat, Philadelphia, 1872, p. 150.)

[4] In a case recorded by Abercrombie, the abscess had to be opened three times before the process of suppuration terminated. Quoted by Peter: Dict. des Sciences Méd., Paris, 1864, vol. iv. p. 698.

[5] Loc. cit.

prompt evacuation is the proper treatment. It has been suggested [1] that these abscesses may be opened with the nail of the forefinger, but it is better to effect free evacuation by an incision at the most dependent part with the laryngeal lancet. Some practitioners recommend that a trocar should be employed with the view of avoiding the danger of the pus flowing into the larynx.[2] In all cases this contingency should be guarded against by bending the head promptly forward the moment the incision has been made. Whilst the local affection is being attended to, constitutional treatment will usually be necessary in order to reinvigorate the depressed vital powers. In strumous children, cod-liver oil, phosphate of iron, and iodide of potassium will generally prove useful remedies, whilst in infants the tendency to convulsions may often be successfully combated by bromide of potassium administered every three or four hours in five-grain doses. Finally, when convalescence is established, a change of air and a course of sea-bathing will, in most instances, result in the re-establishment of the patient's health.

RELAXED THROAT AND UVULA.

(Synonym: Chronic Catarrh of the Throat.)

Latin Eq.—Resolutio faucium. Uva descendens.
French Eq.—Relâchement. Atonie du pharynx. Elongation de la luette. Chute de la luette.
German Eq.—Erschlaffung der fauces. Verlängerung des Zapfens.
Italian Eq.—Rilassatezza delle fauci. Ugola allungata.

Definition.—Relaxation with slight congestion and swelling of the mucous membrane of the fauces and an increase in the length, and occasionally in the breadth, of the uvula.

Etiology.—Relaxation of the throat and uvula, in by far the greater number of cases, probably originates in catarrh, or rather in repeated attacks of catarrh. The acute symptoms pass off, but the tissues do not recover their normal tone, and the result is a certain looseness of texture. Relaxed throat is a very common affection in variable climates, especially in those countries where there is a frequent combination of cold and wet weather. In some persons exposure to night air always brings on the affection. Prolonged stay in overheated rooms, on the other hand, especially where much gas is burnt, may also give rise to it. Those who, whilst leading a sedentary life, are inclined to the pleasures of the table and a free indulgence in spirituous liquors, often suffer from relaxed throat. Indeed, the worst cases generally arise from the habitual abuse of the stronger forms of alcohol. In such cases there is often a subacute catarrh of the stomach, which extends upward through the œsophagus to the pharynx. The affection, when occurring early in the morning, is brought on from exposure or excess the previous evening, from hypo-

[1] Niemeyer, 7th Germ. edit. p. 519.
[2] Abelin: Retro-pharyngeal Abscess in Young Children. Nordiskt Medicinskt Arkiv, Stockholm, 1871, iii. No. 24.

static congestion of the throat occurring in the recumbent position, or perhaps from sleeping with the mouth open and the consequent drying of the mucus on the surface. When the relaxed condition, however, only causes trouble in the evening, it then probably results from fatigue. In a few instances relaxed throat appears to be due to some reflex irritation, and women suffering from uterine complaints are often troubled with this affection. Relaxation of the uvula may also arise in scrofulous children in whom there is often a generally relaxed condition of the system. In a few cases an abnormal length of the uvula has been observed to be a congenital malformation. Paralysis of the veil of the palate, consequent on progressive bulbar disease or diphtheria, also produces a falling of this part.

Relaxation of the pharynx rarely leads to any serious alterations in structure, and, though it may persist for years, seldom gives rise to anything more than a temporary inconvenience.

Symptoms.—On waking after a night's rest, a person affected with relaxed pharynx experiences a peculiar fulness and stiffness of the throat, often accompanied with a disagreeable sensation, as if due to the presence of a foreign body. The throat feels dry and parched, and repeated efforts are made to dislodge the supposed cause of irritation. These symptoms may last for days together, but they often subside as soon as the patient has taken a sip or two of hot coffee or tea. The examination of the throat sometimes affords only negative results, but in most cases the fauces are seen to be relaxed and slightly swollen, the whole of the palate dependent, and the uvula elongated. There is also generally a varicose condition of the smaller veins. Sometimes the surface of the pharynx has a peculiar pellucid appearance from being covered by a transparent film of mucus. When the uvula is much affected the symptoms are more troublesome and very persistent—a distressing, tickling cough often continuing during the whole day. In the worst instances the uvula may be so much lengthened as to be drawn into the larynx in inspiration. This event usually occurs when the patient is sleeping on his back, and he awakes suddenly with a suffocative attack. In cases of this kind the abnormal condition of the organ often produces nausea and vomiting by irritating the fauces and base of the tongue. On inspection the relaxed state of the uvula can at once be perceived. The mucous membrane and submucous tissue are the structures affected, there being usually no increase in the bulk of the azygos uvulæ muscle. The mucous membrane sometimes forms a kind of opaline vesicle at the extremity of the uvula, and from this point a constant dripping of watery mucus may take place. It must not be forgotten, however, that considerable elongation of the uvula may sometimes exist without giving rise to any marked subjective symptoms.

Pathology.—The blood-vessels are dilated and gorged, and the tissues generally either swollen from serous infiltration, or thickened by semi-organized products. The glandulæ are usually both dilated and hypertrophied.

Prognosis.—A cure can nearly always be effected, if the patient avoids the causes of the disease, and submits to proper treatment.

Treatment.—The various exciting causes already referred to must be carefully avoided, and the patient must live in a dry and bracing atmosphere. If there be any hepatic congestion, or irregularity of the bowels, a glass or two of Friedrichshall or Pullna Bitter Wasser, should be taken early in the morning. If the affection be slight, the free use of a gargle

of chlorate of potash, night and morning, will sometimes quickly relieve the unpleasant symptoms. Mildly astringent lozenges, such as rhatany and kino (Throat Hospital Phar.), taken four or five times a day, are very useful. When the affection is obstinate the local application of astringents, such as solutions of perchloride of iron (℥ j. ad ℥ j.) or chloride of zinc (grs. xxx. ad ℥ j.), combined with the internal use of tonic remedies, will sometimes effect a cure. If, however, the uvula is much elongated and occasions troublesome symptoms, it should be shortened. Abscission of this fold of mucous membrane has been practised from a very early date.[1] The ordinary method is to cut off a small portion with a pair of scissors, whilst the extremity of the uvula is held with forceps. The operation is, however, more efficiently and rapidly performed with the aid of the uvulatome, in the manner already described. Occasionally severe and continuous hemorrhage follows the little operation, but it can always be checked by slowly sipping a teaspoonful or two of the tannogallic gargle of the Throat Hospital Pharmacopœia. The immediate effect of the operation is generally to cause a painful sore throat. The patient can only swallow liquids, and even these cause pain. There is, indeed, sometimes *odynphagia* of the most severe character. Occasionally the pain extends to the ears, and severe spasmodic contractions of the pharynx may take place. In some instances, on the other hand, the operation does not give rise to any trouble, and in most cases the pain passes off in a day or two. The soreness of the throat may be greatly relieved by frequently sucking a marshmallow lozenge (Throat Hosp. Phar.). The bland substance of the lozenge adheres to the wound, and forms a protecting covering. The wound soon heals, and the advantages which result from the removal of the part are in most cases almost immediately experienced. The irritating fits of coughing at once subside, and a very great improvement often takes place in the patient's general health. *In cases where there is any follicular disease of the throat, it is most important to cure that affection before the uvula is amputated*, as owing to the after-pain caused by the removal of the uvula, patients will not submit to any further treatment, when they have recovered from the operation. Hence the patient remains uncured, and the operation, and he who performed it, are brought into discredit.

ULCERATED THROAT.

Latin Eq.—Fauces ulcerosæ.
French Eq.—Ulcérations de la gorge.
German Eq.—Geschwürige Pharynxentzündung.
Italian Eq.—Angina ulcerosa.

Definition.—A superficial ulceration of the fauces, due to slight septicæmia.

Etiology.—Ulcerated throat is an affection often encountered in debilitated persons exposed to the influence of septic poisons. During epidemics of anginose scarlatina, or of diphtheria, this form of sore throat is

[1] See Aretæus, Πέρί αἰτίων Καὶ σημείων, κ.τ.λ., LI. cap. viii.

frequently observed amongst the attendants of the sick. The disease generally manifests itself in persons who have been long exposed to unhealthy influences, or in those who have become weakened from constant watching, loss of rest, and insufficient exercise. Students who are diligent in hospital practice, and those passing much time in the dissecting room, are peculiarly liable to ulcerated sore throat, called by the Germans *angina nosocomii.*

Symptoms.—The first symptom of ulcerated sore throat is odynphagia, which is especially noticed in swallowing the saliva. The throat feels stiff and swollen, the tongue is furred, and the breath offensive. The pulse is generally weak, and the temperature slightly raised. There is great loss of appetite. Though the patient feels drowsy he is often unable to sleep, and there is a sense of general malaise and lassitude, and sometimes shooting pains in the limbs are experienced. The patient also frequently suffers from a splitting headache. On examination it will be seen that the tonsils are somewhat swollen and congested, and that there are one or more small, white, superficial ulcers on the surface of the tonsils or fauces. The ulcers are generally round or oval, and vary in size from that of a millet seed to a shilling, but they are sometimes even larger; when there are several ulcers they show no disposition to become confluent.

Diagnosis.—The conditions under which the disease arises, and its rapid development facilitate its diagnosis. The ulcers are seldom covered by any deposit or membrane, and there is generally no difficulty in determining the nature of the affection.

Pathology.—The disease is probably a low form of inflammation, in which there is a slight alteration in the constitution of the blood. The nutrition of the part is impaired, and molecular death takes place.

Prognosis.—This is always most favorable.

Treatment.—The patient should at once be removed from the insalubrious surroundings, and have the advantage of healthy atmospheric conditions. The bowels should be evacuated by the administration of a mild aperient, but, on account of the generally asthenic nature of the affection, mercurial cathartics are to be avoided. To combat the fever and the symptoms of septicæmia, quinine and ammonia should be administered as soon as the tongue has cleaned; and to relieve the local condition, antiseptic gargles (Throat Hospital Phar.) are often useful, especially those containing chlorate of potash, permanganate of potash, borax, carbolic acid, or chlorinated soda. Mildly astringent lozenges, such as rhatany or kino (Throat Hospital Phar.) may frequently be used with advantage. In some cases, however, owing to the great swelling, gargling and sucking lozenges are attended with so much pain that we must resort to some other plan of local medication. Under these circumstances the use of inhalations sometimes gives relief, and a soothing vapor, such as the Vapor Benzoini or Vapor Conii (Throat Hospital Phar.) may render good service. Warm inhalations are especially indicated when the inflammation is slight and circumscribed. On the other hand, when the inflammatory process is very acute, sucking ice answers best. Ice, applied in a bladder to the head, also at once removes the cephalalgia, so often present. The patient should be fed on bland and nutritious fluids, and a few glasses of good wine, well diluted with water, will be of service.

Under suitable treatment the patient rapidly improves, and convalescence is generally thoroughly established in a few days.

GRANULAR PHARYNGITIS.

(Synonyms: Follicular Pharyngitis. Granular Pharynx. Clergyman's Sore Throat. Chronic Pharyngitis.)

Latin Eq.—Dysphonia clericorum.
French Eq.—Angine glanduleuse. Angine granuleuse. Angine papillaire. Pharyngite glanduleuse. Pharyngite granuleuse.
German Eq.—Chronischer Pharynxkatarrh. Chronischer Pharyngitis.
Italian Eq.—Faringitide cronica.

Definition.—Chronic inflammation of the follicles of the pharynx occurring in two forms—the hypertrophic and the exudative. In the hypertrophic form the diseased glands, or the epithelial structures, become enlarged, and appear as elevated granular bodies on the surface of the mucous membrane. In the exudative form the glands give exit to a white, inspissated secretion, which projects from the point of issue, or adheres in patches to the mucous lining of the pharynx. What relations—if any—the two forms bear to each other has not been determined.

History.—The existence of this disease was scarcely recognized until 1846, when Chomel [1] published some remarks on a special state of the pharynx, which he called *l'angine granuleuse.* Nevertheless, as early as 1741, Van Swieten [2] had mentioned in his commentary on Boerhaave that the "mucous crypts" of the pharynx, larynx, and œsophagus, when obstructed and swollen, gave rise to troublesome symptoms, and to deficiency in the mucous secretion. The monograph of Chomel had scarcely been perused by the body of the profession when Horace Green,[3] of New York, published a treatise on the same subject based on careful observations of the malady during a period of more than six years. He gave a good description of the disease under the name of *follicular disease of the pharyngo-laryngeal membrane.* In 1851 Buron [4] read a thesis on chronic pharyngitis, confirming the observations of Chomel, and in 1857 Guéneau de Mussy [5] still further elucidated the subject in the most systematic and exhaustive monograph that has yet appeared. The literature of the disease is now extensive, but although the objective and subjective symptoms have been well described, there is still considerable divergence in the views of the various authors, especially with respect to the pathology of the affection. The morbid anatomy of follicular disease of the degluto-respiratory tract has not yet been studied sufficiently thoroughly to enable us to determine the exact relations which the various appearances presented during life bear to each other.

Etiology.—The causes of follicular pharyngitis are *predisposing* and

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[1] Gazette Médicale, 1846, p. 310.
[2] Comment. in H. Boerhavii Aphor. de Cognosc. et Cur. Morbis, Lugduni Bat., 1741, vol. ii. p. 575.
[3] A Treatise on Diseases of the Air-Passages, &c., New York, 1846.
[4] De la Pharyngite Chronique, Thèse de Paris, 1851, No. 203.
[5] Traité de l'Angine Glanduleuse, Paris, 1857.

exciting. The strumous, gouty, and rheumatic diathesis [1] *predispose* to the disease. Heredity is considered by Green [2] to be an influential factor in its production. A majority of cases are met with between the ages of twenty-five and thirty-five years,[3] but the affection frequently shows itself much earlier. Thus Guéneau de Mussy [4] mentions instances occurring in children under fifteen years, and I have met with the disease in children of eight, six, and even three years of age. Amongst adults the malady is more common in the male than in the female sex—a fact which can perhaps be explained by the much greater exposure of men to the exciting causes. The delicate state of the mucous membrane of the throat, which often remains after severe attacks of influenza, scarlatina, measles, and small-pox, sometimes appears to render the individual liable to follicular disease. The most potent of all the *exciting causes* of granular pharyngitis is overexertion of the voice. In those of sound constitution and good muscular development considerable exercise of the vocal organ is not followed by any bad effects, but, on the contrary, such exertion rather acts as a local tonic. When, however, the vital powers are naturally feeble, and the bodily conformation ill-adapted for prolonged and forcible effort, the overexertion of any organ invariably impairs the activity of its functions and produces disease.

A very large proportion of the cases of granular pharyngitis which have come under my notice have been amongst those using the voice, such as the clergy, singers, hawkers, and costermongers. In almost every instance the evidence of constitutional delicacy is well marked, and most of the patients present an anæmic appearance. In nearly all cases where the origin of the affection cannot be attributed to overuse of the voice, the immediately exciting cause is exposure to cold. A series of three successive causes can thus be laid down as being in most instances con-

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[1] Since Guéneau de Mussy published his work, already referred to, French physicians have regarded the herpetic diathesis as a very frequent cause of the affection. The term "herpetic" is, however, so vague that I do not feel myself justified in making use of it. The most complete definition of the diathesis and its manifestations is given by Bouchut et Deprés in their Dictionary of Medicine. In the following extracts the terms, *diathèse dartreuse*, *diathèse herpétique*, and *herpétisme*, are synonymous :—

Dartes.—"Les maladies de la peau qui dépendent d'une diathèse autre que la syphilis, la scrofule, le rhumatisme ou l'altération du sang par les poisons et les virus sont des *dartres*. La disposition de l'organisme qui favorise l'apparition des dartres constitue *l'herpétisme*.

"Pendant la jeunesse les dartres (furfuracées, papuleuses, vésiculeuses, pustuleuses, squameuses, tuberculeuses) occupent la peau, mais par suite d'un traitement répercussif ou par le fait des changements organiques opérés par l'âge elles se portent à l'intérieur sur les muqueuses, et engendrent les angines et les bronchitis chroniques, l'emphysème, l'asthme, la gastralgie, la diarrhée, la dyspepsie, le flux vaginal et une foule de maladies chroniques."

Herpétisme.—"La constitution de certains sujets favorable au développement des dartres ou des maladies internes dues au principe dartreux, est ce qu'on appelle *herpétisme*. C'est une diathèse qui produit à l'extérieur sur la peau, des vésicules, des pustules, des squames, des bulles, et à l'intérieur des catarrhes muqueux chroniques d'où resultent un grand nombre de maladies viscérales graves."

Herpétique.—"Qui est de nature dartreuse. Ainsi on dit qu'un individu affecté de dartres est atteint de la diathèse herpétique."

The words *dartre*, *tetter*, and *zitter* are all supposed to be derived from the tremulous or twitching movement to which skin diseases sometimes gives rise. They seem too vague to be made the basis of a diathesis, which can only be formulated as a negation (see *dartres* above), but which is so comprehensive that it includes nearly all skin diseases.

[2] Op. cit. p. 159. [3] Ibid. p. 165. [4] Op. cit. p. 18.

cerned in producing the disease, viz.:—1. Constitutional predisposition (this includes any cachexia, but especially the strumous diathesis); 2. Overexertion of the voice (with consequent weakening of the mucous membrane of the throat); 3. Exposure to cold—the latter being the most immediate, though not the most potent, of all the causes. In addition, the application of any irritant to the already weakened mucous membrane is capable of exciting the morbid action of the glandular apparatus. My own experience does not, however, coincide with that of Green [1] and Guéneau de Mussy [2] with respect to the use of tobacco. It is possible that, in certain persons, excessive smoking may cause congestion of the mucous membrane of the throat, and sometimes tend to produce a blocking up of the mouths of the follicles, but the abuse of tobacco more often leads to simple chronic relaxation. It has been asserted that those who are compelled to breathe constantly a tainted atmosphere, or to reside in a damp climate, are, *cæteris paribus*, most liable to be attacked by this malady; and that those who are subjected to the presence of irritating gases or powders in the atmosphere, as is the case in chemical works, metal factories, cotton mills, coal mines, etc., are prone to the disease. I have met with many cases in which the etiology could not be arrived at.

Symptoms.—Patients affected with follicular pharyngitis do not, as a rule, experience any painful sensations at the outset of the disease. The first symptoms are generally confined to a sense of stiffness and dryness in the throat, and a tickling cough. Should the patient, however, be subject to severe fits of coughing, he almost always complains that "it hurts him to cough;" and, on questioning him more closely, it can be ascertained that each impulse of coughing causes a feeling of tenderness and soreness about the upper part of the larynx and the arch of the palate. Amongst public speakers or singers the first symptoms which attract the attention of the patient, and generally occupy his mind to the exclusion of all other phenomena attendant on the disease, are hoarseness and a loss of power over the voice. As the morbid condition of the follicles increases, their functions are interfered with. Dryness and soreness of the throat supervene, causing the patient great inconvenience, and constituting what has been called *pharyngitis sicca*. An insupportable sense of pricking and heat is often felt in the pharynx, whilst a harsh, dry cough, accompanied by repeated hawking efforts, simulates pulmonary phthisis. The larynx almost constantly feels obstructed, and the sufferer is led to make continual fruitless attempts to clear the throat. Small quantities of viscid mucus are occasionally expectorated, whilst the strain of excessive coughing sometimes causes the sputa to be tinged with blood. In the most pronounced cases of granular pharyngitis the diseased condition of the follicles extends to the naso-pharyngeal space and posterior nares, to the front of the soft palate and uvula, and to the upper part of the larynx and œsophagus. As a consequence, therefore, of the implication of these parts the malady is sometimes accompanied by impairment of the senses of hearing, smell, and taste, in proportion as the orifice of the Eustachian tube, the pituitary membrane, or the mucous covering of the palate participate in the morbid process. Hoarseness and feebleness of voice result from the larynx being involved, and the general soreness and stiffness of the parts concerned in the production of speech cause a marked hesitation and effort in articulation. When the upper part of the œsophagus or the epiglottis becomes affected considerable

[1] Op. cit. p. 174.

[2] Op. cit. p. 28.

pain in swallowing usually results, and some patients are reduced to the necessity of subsisting altogether on liquid food. The symptoms are, as a rule, much more marked in the exudative than in the hypertrophic form of the disease. As Peter [1] remarks, however, a considerable amount of enlargement of the follicles of the pharynx, etc., may exist, and, at the same time, give rise to so little inconvenience that the patient may be quite unconscious of there being anything unusual in the condition of his throat.

The objective symptoms of both forms of follicular pharyngitis are most characteristic, and at once strike the observer on making an inspection of the part. In the *hypertrophic form* of follicular disease, the locality of the throat first affected is the posterior wall of the pharynx. In the early stages of the disease the mucous membrane in this situation may be seen to be dotted with small elevations, about the size of a millet-seed, entirely isolated from each other. As the disease advances, these granulations increase in number until they become packed so closely together as to give a reticulated appearance to the part, and finally they coalesce and form broad, flattened elevations, or long ridges running in various irregular directions over the mucous membrane. In most cases injection of the superficial veins of the pharynx is present, and these vessels can often be seen pursuing a tortuous course along the furrows, or forming a kind of net-work round the elevations. As the disease advances the granulations become developed on the adjacent parts of the fauces and tonsils, and sometimes give rise to hypertrophy of these glands. Examination by means of the rhinoscopic and laryngeal mirrors will be required in order to estimate how far the naso-pharyngeal cavity, the lower part of the pharynx, and the larynx are implicated in the morbid process. Coincident with the appearance of these several phenomena there is always considerable perversion of the secretions of the pharynx. This derangement is almost always on the side of deficiency.

In the *exudative form* of follicular disease, the affection generally commences in the tonsils or in their immediate neighborhood, and advances to the posterior wall of the pharynx, the back of the tongue, the epiglottis, and the interior of the larynx. In health the secretion of the follicles appears to the naked eye as a watery transparent fluid, but if the follicles become acutely inflamed their secretion (probably from increase of the corpuscular elements) becomes milky in color and consistence. This condition is constantly seen in follicular tonsillitis. If the inflammation is less acute and more persistent, the milky secretion becomes inspissated, and leads to the formation of the caseous deposits so characteristic of the disease. In the earliest period, the throat is seen to be dry and glistening, whilst the orifices of the follicles are bright red, and the intervals of mucous membrane between them generally slightly hyperæmic. Later on, however, the diseased follicles discharge a morbid secretion, and viscid mucus is often seen adhering in patches to the follicles, or filling up the intervals between them. On pressing the enlarged follicles this exudation may be seen to issue from them, generally by a single, minute aperture, situated near the centre of the elevation. The secretion may have the cheesy character already described, or may resemble the matter which can be pressed out of the follicles of the skin of the nose or face when affected with acne. Sometimes the secretion, after exuding from the follicles, adheres to the part in small white patches of

[1] Dict. des Sciences Méd., vol. iv. p. 749.

irregular shape, about 1-16th of an inch in diameter, or hangs like a thread from 1-20th to 1-8th of an inch in length from the point of exit. On inspection, under these circumstances, the pharynx is seen to be dotted at numerous points, but especially about the pillars of the fauces and tonsils, by patches of white accretion resembling, in color, consistence, and odor, decomposing cream cheese. According to my experience, ulcerations of any size or depth rarely occur as a direct consequence of follicular disease of the pharynx, and, when present, are generally due to some associated disease, such as syphilis or phthisis.[1] Sometimes the secretion is chalky in appearance, and calcareous in composition. Unlike the hypertrophic form of the disease, instead of there being any disposition to increase of tissue, the tendency appears to be of an opposite nature—*i. e.*, toward an atrophy of the structures and enlargement of the cavity of the pharynx. The case reported by Guéneau de Mussy,[2] in which calcareous matter could be pressed out of the follicles situated in and about the tonsils, seems clearly to belong to the exudative form of the disease, and although unique in that writer's experience, is a phase of the malady often met with in this country and in Germany.[3] A general relaxation and loss of tone of all the structures of the pharynx soon results from the disease, and the uvula becomes in some instances so much elongated as to rest on the base of the tongue, or even to hang down into the larynx.[4] Titillation of the base of the tongue and epiglottis by the elongated uvula, is one of the commonest factors in the production of the incessant, tickling cough.

Pathology.—The pathological varieties of this affection have not as yet been sufficiently worked out to enable us to determine the relations between the two kinds of granular disease. Whether the *exudative form* is the result of degenerative changes in glandulæ previously hypertrophied, or whether the exudation is the product of a simple morbid secretion, is at present unknown. The nature, differences, and extent of the morbid alterations in the mucous membrane and its secretory glands have yet to be elucidated, but the tendency of investigation is to show that the hypertrophic and exudative diseases, though they may coexist, are totally distinct affections, differing in their symptoms, course, and pathology, and requiring, as is shown in this article, totally different treatment. According to Stoerk,[5] in the *hypertrophic form* the granulations consist of large, nearly round, swollen, epithelial cells, the layers of hard compressed cells or flattened scales which usually cover and protect the surface having disappeared. The morbid changes are in fact more in the epithelium than in the follicles. In a case of *exudative* disease reported by de Mussy,[6] where a microscopic examination was made by Drs. Sappey and Robin, the principal histological changes noted were as follows:—The tubules of the follicles were found considerably enlarged, both as regards the diameter of their cavity and the thickness of their walls. In the follicles which were most hypertrophied and indurated, small calcareous concretions were discovered, composed principally of

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[1] Green considers ulceration as frequent: Op. cit. pp. 51—180 et seq.

[2] Op. cit. p. 189.

[3] Wendt: Ziemssen's Cyclopædia (German edition), vol. vii. part I. p. 266.

[4] See a case depicted by Dr. Green in which suffocation nearly occurred on several occasions from the end of the uvula being drawn into the larynx during inspiration: Op. cit. p. 270.

[5] Klinik der Krankheiten des Kehlkopfes. Stuttgart, 1876, p. 114.

[6] Op. cit. p. 87.

carbonate of lime. In some of the glands these concretions were numerous, and packed together so closely as to present, when detached, a crystalline appearance, owing to their surfaces having been moulded into polyhedral, faceted figures. On the other hand, the cellular tissue connecting the secretory tubules and the epithelium lining their internal walls presented but little departure from the normal condition beyond a very slight thickening. With respect to the vessels of the hypertrophied follicles, the capillaries showed no perceptible change, but on the whole the diseased glands appeared to be less vascular than in the healthy pharynx.

The cheesy secretion consists of the *débris* of epithelial cells, of molecules, and oil globules.

Diagnosis.—The recognition of follicular pharyngitis, whether hypertrophic or exudative, presents no difficulty, and the condition can scarcely be confounded with any other disease. In cases where the cheesy exudation is very abundant and coats the surface of the pharynx, a person who had never seen an example of either disease might suppose that diphtheria was present. As a rule, however, the discharge in the follicular disease adheres to the surface of the mucous membrane in small *isolated* patches, and is very different to the tough, membranous exudation which occurs in the more serious malady.

Prognosis.—I cannot at all acquiesce in the opinion of Dr. Green,[1] that pulmonary phthisis can ever owe its origin to granular pharyngitis. Nor is it more likely that when the follicles of the œsophagus become implicated in the morbid action, malignant disease of the gullet can ever be a direct consequence.[2] Phthisis, however, is sometimes associated with granular pharynx. Most cases of follicular disease of the pharynx get well under appropriate treatment, *i.e.*, as far as the troublesome sensations are concerned, but with respect to the vocal function, the prognosis is not always so favorable, especially as regards public speakers, singers, etc., if the disease has existed many years. The vocal organ is extremely likely to remain permanently weakened, at least to such an extent as to interfere with its constant professional use. The *exudative* variety of the disease is much more difficult to eradicate than the hypertrophic form.

Treatment.—As many writers have a strong belief in the purely diathetic character of the local phenomena attendant on granular pharyngitis, the treatment prescribed is often almost entirely limited to constitutional measures. In my experience,[3] however, topical applications have been so generally successful that I cannot but conclude that the local medication of the affected parts is the essential factor in treatment. The two forms of the disease as described in this article require a different method of topical treatment. When the *hypertrophic form* alone is present, no remedy is so productive of good results as the London paste (Throat Hosp. Phar.). This caustic should be applied to each granulation separately, but only two or three of the elevations, and in some cases only one spot, should be touched on the same day. The mode of procedure is as follows:—Having made the powdered preparation into a thick cream by rubbing it up with a sufficient amount of water, a small quantity of the caustic is applied to the desired part with the pharyngeal spatula (page 8).

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[1] Op cit. p. 118. [2] Ibid. p. 129.

[3] See also Kunze: Compendium der praktischen Medicin, p. 218; Niemeyer: Pathologie u. Therapie, vol. i. p. 500; and Wendt: Op. cit. p. 278.

Immediately after the application has been made the patient should be directed to gargle and wash out the throat with cold water, so as to remove any particles of the caustic that may remain adherent to the part touched. The London paste should be persevered with in this way until all the granulations are destroyed. As a rule, one touch of the paste is sufficient to remove a granulation, and establish a healthy action in the part; but if the elevation be very large, or if there be many separate raised spots, a number of applications may have to be made. It is scarcely necessary to observe that it is most important not to set up extensive inflammation by using the paste too freely on any one occasion. In some persons the application may be made every day, whilst in others twice or three times a week will be sufficient. In the intervals milder remedies can often be used advantageously—such as the pigmenta of perchloride of iron or chloride of zinc (Throat Hosp. Phar.); and when there is much irritation of the fauces, consequent either on the disease or on the action of the caustic, a sedative inhalation of benzoin or hop (Throat Hosp. Phar.) is beneficial.

It has been recommended that the elevations should be destroyed by galvanic,[1] or actual,[2] cautery; but as the granulations can be readily got rid of by a simple escharotic, complicated processes and alarming methods had better be avoided.

As regards the *exudative form* of follicular pharyngitis the local treatment can be carried out without having recourse to so strong a caustic as the London paste. My practice in such cases is first to scrape the mucous membrane wherever the white spots appear with the "pharyngeal curette," already described (p. 9), and, having thus cleared away the secretion, to apply the solid stick of nitrate of silver—which should be carefully pointed for the purpose—to each spot which discharges an abnormal secretion.

Whilst the local treatment is being accomplished, internal remedies calculated to give tone to the vital powers and improve the general health of the patient should be administered. Struma, anæmia, syphilis, etc., must be met by the exhibition of cod-liver oil, iron, iodide of potassium, etc. After the topical measures have been completed, the permanency of the cure may usually be established by change of air, residence at the seaside for a month or two when the season is suitable, or by directing the patient to use the arsenical waters of Mont Dore, the hot sulphur springs at Aix-les-Bains, Cauterets, or Weilbach, or the saline waters of Ems. By a course of mineral waters and sprays the local weakness and diathetic condition are both generally greatly ameliorated. In the case of strumous children, benefit often results from a stay at Woodhall Spa, whilst the bracing air of Harrogate, Tunbridge Wells, and similar places often proves invigorating.

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[1] Michell: Deutsche Zeitschrift für Chirurgie, ii. Bd. 2 Heft.
[2] Foulis: Glasgow Med. Journ., October, 1877.

PUTRID SORE THROAT.

Latin Eq.—Cynanche maligna. Angina putris.
French Eq.—Angine gangréneuse. Angine maligne.
German Eq.—Angina maligna oder gangrænosa.
Italian Eq.—Angina maligna.

Definition.—Primitive gangrene of the pharyngeal mucous membrane, constituting an affection per se, and originating independently of any other malady, such as diphtheria, scarlet fever, etc.

History.—As Peter[1] well observes, the history of this affection may be divided into three periods. First, the ancient period, when a belief founded principally on the vague descriptions of Hippocrates and Aretæus, prevailed that the disease was a common one, whilst in fact almost all the reported examples were cases of diphtheria. Secondly, the period of Bretonneau, subsequent to 1821, when the researches of that observer proved that the so-called cases of gangrene were only instances of diphtheria, and that a true gangrenous lesion was rarely, if ever, present in that disease. As a consequence of this discovery a majority of the profession were led to affirm the non-existence of a primitive gangrene of the throat. Thirdly, the contemporary period, in which, owing mainly to the observations of Gubler[2] and Trousseau,[3] the existence of the malady has been clearly recognized, whilst the conclusion has been arrived at that the disease is an extremely rare one.

Etiology.—Malignant sore throat appears always to be the result of blood-poisoning. It sometimes commences as a severe inflammation, which quickly leads to gangrene; whilst at other times it is gangrenous from the commencement. I have met with several instances of the inflammatory form, but only one case in which gangrene was the initial local manifestation. Trousseau remarks that "It has for its fundamental character mortification of the mucous membrane of the pharynx, which takes place at the first onset of the malady, and occasionally spreads to the cheeks and lips. The disease is comparable to gangrenous stomatitis."

Symptoms.—In some instances sthenic phenomena, with considerable fever and local inflammation, indicate the advent of the malady, but in most cases the symptoms are adynamic from the first. A premonitory stage is not always present, and soreness of the throat, rapidly becoming intensified, is often the first symptom which disturbs the feelings of the patient. The gangrene frequently supervenes with great rapidity, so that in two or three days a portion of the pharyngeal mucous membrane may be sphacelated. In some cases there is considerable swelling of the cervical glands, but this lesion is not invariably present. As the morbid process becomes fully developed, it is in all instances accompanied by a remarkable prostration of the vital powers. A state of collapse comparable to that which occurs in cholera indicates the intensity of the blood-

[1] Dict. des Sciences Médicales, Paris, 1866, vol. iv. p. 700.
[2] Archiv. Générales de Méd., 1857, vol. ix. p. 513.
[3] Clinique Méd. de l'Hôtel-Dieu, Paris, 1865, p. 324.

poisoning; there is great loss of body heat, and the pulse soon becomes slow and infrequent. Thus in one of Gubler's [1] cases the contractions of the heart sank to fifteen per minute. The extremely feeble condition of the circulation is shown by the pallor, coldness, and bluish discoloration of the skin, especially of the extremities. The expression of the face is strikingly altered and pinched. The patient generally dies from syncope, the intelligence often remaining intact to the last. In some cases, however, the sufferer becomes comatose, and occasionally symptoms of profound lesions of the thoracic or abdominal viscera are manifested. Should the lungs be affected copious hæmoptysis results; whilst, if the gangrenous process invades the alimentary tract, an abundant, fetid diarrhœa supervenes, which all remedies are powerless to check. Occasionally a general tendency to hemorrhage is manifested, and a persistent bleeding occurs simultaneously from the lungs, bowels, nose, mouth, and even under the skin, which becomes covered with petechiæ, and ultimately sphacelated at the points of ecchymosis. Trousseau saw diplopia and phlebitis of all the superficial veins about the end of the third week. Sometimes œdema of the glottis quickly proves fatal to the sufferer, and I have treated three cases of this kind in which tracheotomy proved only a temporary palliative. Throughout the disease the odor of the breath is so extremely fetid that it is alone often sufficient to enable a practitioner who has once previously seen a case to diagnose the disease as soon as he enters the room of the patient. When, however, the gangrene is of very slight extent, this symptom may be absent.

On inspecting the pharynx in the first stage of the disease the appearances are generally by no means characteristic of the approach of so serious an affection, although the peculiar foul smell of the breath may be quite perceptible. As soon, however, as the process of gangrene has commenced, the back of the pharynx, the pillars of the fauces, and the tonsils can be seen covered with discolored patches—sometimes almost black, which are slightly elevated above the surrounding surface, and forming eschars ultimately detach themselves from the tissues beneath. Ulcerations, variable in extent and depth, result from the separation of the sloughs. In the worst cases the disease makes constant progress in the direction of the mouth, the œsophagus, and the air-passages, and terminates its onward course only by the death of the patient.

Typical cases of this disease have been described by Gubler [2] and Trousseau; [3] and Rilliet and Barthez [4] have reported some instances as occurring in children under five years of age. Some of these followed an attack of scarlatina or measles, and do not belong to the diseases now under consideration, but others were evidently examples of primitive gangrene of the throat.

Pathology.—As most cases of putrid sore throat prove fatal, opportunities of studying the morbid anatomy of the disease occur from time to time. In those instances where the gangrene is circumscribed, patches of an oval or circular shape, from one-twentieth to half an inch in diameter, are found on the mucous membrane of the pharynx, and frequently on the epiglottis and upper part of the larynx. The surface of these patches, after death, is depressed, and their color varies from a dark gray

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[1] Loc. cit. p. 518. [2] Loc. cit. [3] Loc. cit.

[4] Archiv. Générales de Méd., N.S. 12, 1841, p. 446 et seq. For other cases see Musset: Union Méd., 1860, 2d series, t. vii. p. 436; and Bouchut: Gazette des Hôpitaux, 1858, p. 170.

to an absolute black. The edges are perpendicular, and of dirty yellow color, and the mortified structures exhale a gangrenous odor. The process of destruction is generally confined to the mucous membrane and submucous tissue. The beds of muscular fibre are laid bare, but their substance is usually intact, though sometimes softened. When the eschar has fallen off, the resulting ulcer has occasionally been observed to be covered with a delicate false membrane. In the worst examples of the disease the sphacelated patches can be noted in the larynx, trachea, lungs, œsophagus, and throughout the alimentary tract.

Diagnosis.—The peculiar gangrenous odor is sufficiently characteristic to enable a person who has once smelt it to recognize at once the presence of the mortifying process. Diphtheria is the only disease that can be confounded with putrid sore throat, but the resemblance is not sufficiently great to lead an observant practitioner into error. The grayish black patches in the pharynx may exist in both diseases, but in diphtheria they are at first whitish and gradually become darker, whereas in true gangrene the diagnostic appearance is present from the first moment that the eschars begin to form. In diphtheria the submaxillary and cervical glands frequently become much swollen at the outset of the disease, but in putrid sore throat these parts in some cases remain altogether unaffected, whilst in others the tumefaction is but slight. The fetor of the breath in diphtheria is not very perceptible at first, but gradually increases as the disease becomes developed. In putrid sore throat the distinctive gangrenous odor is present at the onset of the malady, and frequently even before inspection can detect any considerable lesion in the pharynx.

Prognosis.—As putrid sore throat is only a local manifestation of a profound blood-poisoning, the prognosis is necessarily extremely grave. But few cases of recovery are on record, and in most instances the patient has been carried off in a few days. Trousseau,[1] however, saw a case which ultimately did well, and the example related by Musset[2] also terminated in recovery. I have met with two cases which recovered, and three, already referred to, which proved fatal.

Treatment.—Active measures are imperatively demanded in the treatment of putrid sore throat. Trousseau and Gubler had recourse to applications of strong hydrochloric acid, in order to destroy the diseased tissues, but, keeping in view the general nature of the malady, little can be expected from topical medication. Sedative and antiseptic gargles and sprays are the most suitable local remedies. For this purpose borax, myrrh, bromide of potassium, and permanganate of potash may be employed. The most important indication, however, is to gain time, and if possible support the vital powers until the phenomena of the blood-poisoning have passed away. With this view quinine and bark should be administered every three or four hours, and stimulants freely given. In the case successfully treated by Musset, perchloride of iron—about 30 grains in the twenty-four hours—was given. Whatever drugs are chosen, the diet must be of the most concentrated and nutritious description, and strong beef-tea, eggs beaten up with brandy, etc., must be administered every hour or two. Nutritive enemata, such as are recommended in the article on "Stricture of the Œsophagus," should also be had recourse to, when the condition of the throat interferes to any extent with deglutition.

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[1] Loc. cit.

[2] Loc. cit.

HERPES OF THE PHARYNX.

Latin Eq.—Herpes pharyngis.
French Eq.—Angine herpétique. Herpès guttural.
German Eq.—Herpes des Schlundkopfs. Herpetische Angina.
Italian Eq.—Erpete della faringe.

Definition.—An eruption of the mucous membrane of the pharynx, running an acute course, analogous to that of herpes when appearing on the skin.

Etiology.—Exposure to cold appears to be the principal cause of herpes of the pharynx. According to Gubler[1] the disease is a kind of eruption in the throat, constituting, as it were, the crisis of a fever *a frigore*. On this account it is most frequent in cold, damp climates, and at those seasons of the year when sudden changes of temperature and inclement weather prevail. In England it is a rare affection, and all the cases I have met with have occurred in the spring or autumn. I have met with one case in which the disease attacked a child three years consecutively —the left side of the palate and wall of the pharynx being the parts affected on each occasion. Women, children, and delicate persons are most liable to the malady, owing doubtless to their being more easily overcome by cold. Féron[2] thinks that mental emotions have the power of determining an attack of herpes of the pharynx; whilst Bertholle[3] believes the affection to be often associated with some uterine disturbance, and states that it is most frequently seen in females at the menstrual periods. Peter[4] considers that the contact of irritating substances with the pharynx, such as hot condiments, and acrid, fetid, or miasmatic exhalations are often productive of the disease. Finally, Trousseau[5] has shown that herpes of the pharynx prevails to a great extent during epidemics of diphtheria, and that the herpetic eruption may resolve itself into diphtheritic patches, leading ultimately even to a fatal termination.

Symptoms.—Herpes of the pharynx is always ushered in by a premonitory stage of general malaise, and symptoms of pyrexia. In a period varying from a few hours to two or three days the patient experiences a sensation of soreness and heat in the throat, which is greatly increased by swallowing. In most cases the local malady provokes considerable salivation. The disease runs an acute course. After four or five days the subjective symptoms diminish greatly in intensity, and at the end of a fortnight the parts usually regain their normal condition.

On inspecting the pharynx at the outset of the disease, a variable number of single or grouped whitish, opaline, vesicles can be perceived. They usually occupy the soft palate, the pillars of the fauces, and the tonsils, and at the apex of each vesicle there is often a dark spot. The mucous membrane forming the base of each vesicle or group of vesicles

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[1] Mémoire sur l'Herpès Guttural, &c. Union Médicale, January, 1858.
[2] De l'Angine Herpétique. Thèse de Paris, 1858, No. 219.
[3] De l'Herpès Guttural, &c. &c. Union Méd. t. xxx. 1866.
[4] Dict. des Sc. Méd., Paris, 1864, vol. iv. p. 715.
[5] Clin. Méd. de l'Hôtel-Dieu, Paris, 1865, vol. i. p. 307 et seq.

is always inflamed, and presents a red, tumefied appearance. The number of vesicles varies greatly in different cases. Sometimes only one or two can be seen, whilst in the worst instances they are arranged so closely together as to become confluent. As Stevenson Smith[1] remarks, the soft palate is occasionally so sprinkled over with minute vesicles, of the size of the head of a pin, that it appears as if it had been dusted with white pepper. The duration of the vesicles is ephemeral; their existence varies from twenty-four to forty-eight hours, but in many cases they appear in successive crops. As the local morbid action pursues its course, the termination of the vesicular stage may take place in three different ways. In the mildest cases the vesicles disappear by reabsorption and leave no lesion to mark their former situation. In another variety of the disease the vesicles burst and a small circular ulcer results, which appears deep, owing to the tumefaction of the mucous membrane. In a day or two these ulcers cicatrize, the infiltration of the adjacent tissues is resolved, and the part resumes its normal condition. In the third and severest form of the disease ulceration takes place, but the sore, instead of healing, becomes covered by a false membrane resembling, both in appearance and structure, the exudation of diphtheria. These phenomena most commonly occur on the palate, and are rarely seen on the posterior wall of the pharynx. When the vesicles are very numerous the patches of exudation may unite at some places, so as to form sheets of false membrane of limited extent. In three or four days, however, the ulcers heal, the exudation becomes softened and detached, and the mucous membrane recovers its healthy state. In some cases the larynx or the orifices of the Eustachian tubes may be the seat of some of these vesicles. The respiration and hearing may be temporarily affected, but serious symptoms are seldom met with. Simultaneously with the outbreak of herpes in the throat, the same eruption may manifest itself in the mouth or on the lips, thus affording a clear indication for the diagnosis of the malady. Certain idiosyncrasies have also been observed in patients liable to suffer from this affection. Thus Tardieu[2] mentions the case of a young man, in whom herpes of the pharynx alternated for several years with a similar eruption of the internal surface of the prepuce. Other instances have been observed in which herpes of the vulva or a general eruption of the malady on the skin coincided with the existence of the pharyngeal affection.[3]

Pathology.—The consideration of the pathology of herpes belongs to the department of the dermatologist, and it is therefore unnecessary to enter here on a question which is fully treated in the text-books on skin diseases. Suffice it to say that the malady is believed to depend on a defect in the innervation of the part brought about by exposure to cold. In addition, Gubler[4] has shown that the morbid action which in herpes causes the formation of crusts on the skin, may give rise to the evolution of a false membrane when the disease attacks mucous surfaces.

Diagnosis.—Herpes of the pharynx can only be confounded with diphtheria, and it is not possible in all cases to differentiate the two diseases with certainty. If the case is seen during the vesicular stage, nothing can be more easy than the recognition of the malady; but at a later

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[1] Edin. Med. Journ., Nov. 1863: False Diphtheria, &c.
[2] Manuel de Pathologie interne, 2d edit. 1857.
[3] Gubler: Loc. cit. Peter: Dict. des Sc. Méd. vol. iv. p. 715.
[4] Loc. cit.

period, in severe instances, when the pharynx has become the seat of several patches of false membrane, the most experienced practitioner may be deceived as to the nature of the disease. According to Peter[1] the diagnosis of herpes of the pharynx at this stage can only be deduced from the existence of one or both of two phenomena—viz., (1) the presence amongst the patches of exudation of small ulcers, such as are commonly consecutive to the rupture of the vesicles, and (2) the appearance of small isolated spots of false membrane, the transparency of which indicates their recent formation, whilst their size and circular shape leads the observer to suspect the previous existence of a vesicle. The coincidence of a herpetic skin eruption with a doubtful throat affection materially assists the diagnosis, although the occurrence by no means affords conclusive evidence as to the nature of the internal malady. In the absence of all the distinctive marks mentioned above, it is sometimes impossible to arrive at a definite opinion, and under these circumstances the case had better be treated as one of diphtheria—an error in that direction being least likely to lead to any evil results.

Prognosis.—Sporadic cases of herpes of the pharynx may be pronounced to be devoid of all gravity. When, however, the disease manifests itself during an epidemic of diphtheria, the observations of Trousseau, as to the probability of the milder affection becoming metamorphosed into the more serious malady, must be borne in mind.

Treatment.—As the onset of the disease is generally accompanied by considerable fever, a diaphoretic or febrifuge medicine is often serviceable. In two cases I found tincture of aconite rapidly relieve the symptoms, and, in the case already referred to, of a child very subject to the disease, the internal administration of arsenic always rapidly effected a cure. The local pain must be met by the use of emollient and sedative gargles, and hot, soothing inhalations, such as the Garg. Boracis, Garg. Pot. Brom., Vapor Benzoini, and the Vapor Lupuli, etc. (Throat Hosp. Phar.); or by the insufflation of starch and morphia (gr. $\frac{1}{4}$), once or twice a day. In the last stage of the malady, when the patches of exudation are becoming detached, the fetor of the breath calls for the employment of antiseptic gargles, of which permanganate of potash in solution is the most effective.

RHEUMATIC SORE THROAT.

Latin Eq.—Angina rheumatica.
French Eq.—Angine rhumatismale.
German Eq.—Rheumatische angina.
Italian Eq.—Angina reumatica.

Definition.—An affection of the throat occurring in persons of rheumatic constitution, characterized by suddenness of attack, severe pain, and the local appearances of inflammation. The symptoms are fugacious, and frequently give place to some local rheumatic manifestation, such as torticollis, lumbago, or subacute articular inflammation.

Etiology.—The poison of rheumatism is the precise cause of this affection, but its outbreak is generally due to exposure to cold. Persons who have had frequent attacks of simple inflammation of the pharynx or

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[1] Loc. cit. p. 716.

tonsils are liable to this form of sore throat should they at any time become the subjects of the rheumatic diathesis.

Symptoms.—The symptoms of rheumatic sore throat have been so well described by Trousseau [1] that I cannot do better than employ his words. "An individual," he observes, "subject to rheumatic pains takes cold. At the end of a few hours he experiences an extremely acute pain in the throat, so that he can scarcely swallow a drop of water, nor even his saliva, the deglutition of these small quantities of liquid causing much more suffering than that of an alimentary bolus. On examining the throat the interior of the pharynx and the veil of the palate present a redness more or less pronounced. The uvula invaded by the inflammation is œdematous and elongated. All these phenomena are going to disappear with great rapidity, because they are fugacious, like most affections of a rheumatic nature. The next day the acute pain of this angina will have ceased as if by enchantment, at the same time that another pain will occupy the neck, producing torticollis; whilst the day after, one of the shoulders may be the part attacked. Again, another day, and the patient will complain of lumbago. As to the angina, its duration may vary from twenty-four to forty-eight hours. It is because they have had to deal with these rheumatic sore throats that the physicians to whom I have referred have been enabled to boast of having gained the power of averting incipient inflammations of the throat. Patients who have had several attacks of this kind of sore throat are able at the outset to distinguish the rheumatic affection from a veritable phlegmonous inflammation; but the physician cannot differentiate the two maladies in the first moments of their appearance." In many rheumatic patients the throat affection is an invariable precursor of a general attack of subacute rheumatism.

Diagnosis.—This affection can seldom be diagnosed at its outset, unless the practitioner has observed similar previous attacks in the same person, but, as remarked by Trousseau, the patient himself is often able to distinguish, by his sensations, the rheumatic nature of the affection, if he has suffered before in the same way. The sudden disappearance of the angina, and the development of unmistakable rheumatic symptoms in some other part of the body, is of course decisive.

Prognosis.—The sore throat of rheumatism is the least serious of any of the local manifestations of that disease, and the only gravity attached to the prognosis depends on the possibility that in the resolution of the angina the malady may select for its seat some more vital part.

Treatment.—The acute pain of the disease is best treated by the use of emollient and sedative gargles, whilst at the same time warm poultices, or spongio-piline, saturated with tincture of opium, may be applied to the neck externally. Constitutionally the specific remedies that are supposed to neutralize, or cause the elimination of, the rheumatic poison, such as bicarbonate of potash, iodide of potassium, salicylic acid, etc., should be administered.

Gouty Sore Throat.

In connection with rheumatic sore throat it may here be stated that there is also a species of angina dependent on gout.[2] I have met with several well-marked instances. In one case a gentleman who frequently

[1] Clin. Méd. de l'Hôtel-Dieu, Paris, 1865, t. 1. p. 332.

[2] See Peterson: Dissert. de Angina Arthritica, Upsal, 1793; also Barthez: Traité des Mal. Goutteuses, Paris, 1855, p. 202 et seq.

suffered from attacks of angina became subject to gout, and was never again attacked with inflammation of the throat. In another case the patient was suffering from acute pharyngitis, when the symptoms suddenly disappeared, and an acute attack of gout developed in the great toe of the right foot; after three days the gouty inflammation of the toe disappeared, and acute hyperæmia of the pharynx supervened. Dr. Prosser James[1] calls attention to the rarity of the acute affection, though he thinks that the mucous membrane of the throat is prone to chronic inflammation in those of gouty constitution. The treatment should be conducted on the principles recommended for rheumatism, with such modifications as the different diathesis may require.

TONSILLITIS.

(Synonyms: Quinsy. Cynanche Tonsillaris.)

Latin Eq.—Inflammatio tonsillarum.
French Eq.—Esquinancie. Amygdalite. Angine tonsillaire.
German Eq.—Angina tonsillaris. Amygdalitis. Entzündung der Mandeln.
Italian Eq.—Angina tonsillare. Tonsillitide.

Definition.—Acute inflammation of the tonsils, which may be of superficial character, or extend deeply into the parenchymatous substance, and may terminate in resolution, abscess, or chronic enlargement of the glands.

Etiology.—The causes of tonsillitis may be divided into *predisposing* and *exciting*. Amongst the former, the greatest prominence must be given to age. The disposition to the disease commences soon after puberty, and is extremely common between fifteen and twenty, reaching its maximum between twenty and twenty-five. The disease is seldom seen in children before the fifth year, and is equally rare in adults after middle age—scarcely any cases occurring after fifty.

The following table of 1,000 cases, treated by me at the Hospital for Diseases of the Throat, illustrates the influence of age:—

Under 10 years		35
10 to 15 "	36	220
15 to 20 "	184	
20 to 25 "	323	542
25 to 30 "	219	
30 to 40 "		143
40 to 50 "		51
50 to 60 "		9
60 to 70 "		*nil.*

This table shows the sudden and remarkably increased proclivity to the disease soon after puberty; for whilst from 10 to 15 years of age there were only 36 cases, from 15 to 20 there were 184. Again, it illustrates the fact that quinsy is more common between 20 and 30 than at all ages put together. The sudden fall after 25 is also remarkable. It will be noticed that young children are very little subject to the disease—an

[1] Sore Throat, Churchill, 1878, p. 120 et seq.

immunity which is all the more curious, when it is borne in mind that chronic enlargement of the tonsils takes place in 26.5 per cent. of cases in the first decennium. In the 1,000 cases tabulated above, 597 were males and 403 females.

Enlargement of the tonsils, congenital or acquired, renders the individual prone to attacks of tonsillitis, and a person who has once been affected with the disease is very liable to have a second attack if at any time he should take cold. This rule holds good to such an extent that in some patients the tonsils, after repeated inflammations, seem to constitute a veritable *locus minimæ resistentiæ*. Under these circumstances, these glands appear to sympathize with every irregularity of the body, and an error of diet occasioning a slight dyspepsia, or a derangement of the sexual organs in females, may give rise to an attack of tonsillitis. Constitutional delicacy, especially when dependent on the strumous diathesis, may also be mentioned as predisposing to quinsy; whilst the poison of gout and rheumatism[1] occasionally seem to favor the production of the disease.

The exciting causes of tonsillitis are almost invariably wet and cold. A surface chill, especially about the head and neck, causes hyperæmia of the internal surface of the throat, and the tonsils are apt to suffer from temporary vascular engorgement. In proportion to the susceptibility of the individual the accidental hyperæmia is likely to lead to an attack of quinsy. It is commonly supposed that the disease is most prevalent in the spring and autumn in this country, owing to the sudden changes of temperature and inclement weather of those seasons.

This, though true of autumn, is a mistake as regards the spring, as the following statistics, taken from cases treated at the Hospital for Diseases of the Throat, conclusively show:—

	1872.	1873.	1874.	1875.	1876.	Total No. of Cases.	Mean monthly of 5 years.
January	14	16	15	21	20	86	17.2
February	10	16	8	17	19	70	14.0
March	9	9	12	27	7	64	12.8
April	11	5	10	18	15	59	11.8
May	15	10	15	30	7	77	15.4
June	13	8	15	11	22	69	13.8
July	17	32	16	32	14	111	22.2
August	19	24	24	25	15	107	21.4
September	43	20	51	52	39	205	41.0
October	41	47	33	26	31	178	35.6
November	17	21	20	22	21	101	20.2
December	11	5	8	16	9	49	9.8
	220	105	235	297	219	1,176	19.6

Mean monthly average 19.6
Average monthly mean of the three spring months (March, April, May) 13.33
Average monthly mean of the three autumn months (Sept., Oct., Nov.) 32.26

[1] Desnos: Dict. de Méd. et de Chirurg. Prat., Paris, 1865, vol. ii. pp. 118, 449; Pollock: Holmes's System of Surgery, vol. iv. p. 339.

There is, however, a possible fallacy in the statistics, which must not be overlooked. From the above tables it would appear that quinsy is more than twice as common in July as it is in December, but it must be borne in mind that persons suffering from acute disease of the throat are far more likely to go out to a hospital in July than they are in December or even March or April. This probable source of error does not, however, apply to the comparisons between spring and autumn, as both seasons are about equally inclement in this country.

Tonsillitis seems to have occurred in an epidemic form in some few instances, but, from the published accounts, there is great difficulty in distinguishing cases of simple tonsillitis from epidemics of scarlet fever.[1] One instance, however, has been described with such care and precision by Mayenc [2] that little doubt can remain as to the almost purely tonsillar nature of the malady. This epidemic occurred in 1818 at Gordon, in France, and lasted for upward of five months, attacking males and females, from fifteen to thirty years of age, in almost equal proportion. Inflammation of the tonsils occurs not only as one of the phenomena arising from the specific blood-poison of scarlet fever, but it may also be present in connection with variola or measles. Desnos [3] states that prolonged residence in a very high temperature, especially if the air be vitiated, may produce an attack of quinsy. Tonsillitis may also originate from the inhalation of irritating gases or from swallowing caustic substances. In such cases, of course, the affection is only a part of a general lesion of the respiratory or alimentary tract. Finally, mechanical causes may give rise to inflammation of the tonsils. The most common of these are wounds, gunshot accidents,[4] the impaction of foreign bodies in the gland during deglutition, such as a piece of bone, the fragment of a fruit-stone, etc.—and the accretions of cheesy or calcareous matter in the lacunæ of the tonsils.

Symptoms.—The symptoms attendant on inflammation of the tonsils vary, both constitutionally and locally, in proportion to the intensity of the morbid action in the part, and hence it is useful to make some division of the malady with a view to the due application of therapeutics. Vidal [5] separates tonsillitis into erythematous and phlegmonous, *i. e.*, superficial and deep, whilst Wagner [6] distinguishes no less than five different forms, viz., (1) simple or superficial, (2) lacunal or follicular, (3) parenchymatous, (4) tonsillitis with abscess in the substance of the gland, and (5) peri- or retro-tonsillar abscess. Clinically, however, there is no well-marked line of demarcation between the five varieties enumerated by Wagner, and as regards treatment it is sufficient to make two divisions of the disease, namely: (1) superficial or follicular tonsillitis, and (2) deep or parenchymatous tonsillitis. The inflammation is generally limited to one tonsil. The symptoms which usher in an attack of quinsy are those of a general malaise, with thirst and heat of skin, and in the severer forms there may be a rigor, and occasionally vomiting. These manifestations are accompanied or quickly succeeded by a sense of stiffness and dryness in the throat, which leads the patient to make constant efforts at deglutition. By degrees the act of swallowing becomes more painful, and as the local

[1] Vidal: Dict. des Sciences Médicales, vol. iv. p. 19; also, Desnos: Loc. cit. p. 129.
[2] Bulletin de la Faculté de Méd. de Paris, 1819, t. vi. p. 396.
[3] Loc. cit. p. 130.
[4] See a case consequent on a pistol shot, by Bédor: Bull. de l'Acad. de Méd., 1833.
[5] Loc. cit.
[6] Ziemssen's Cyclopædia, vol. vi. p. 911 et seq.

inflammation increases the symptomatic fever rises—especially in persons who have not previously suffered from the disease—to such an extent that in the case of young persons the temperature in the first forty-eight hours may reach 105° Fahr. The constitutional phenomena are less marked in the follicular form of tonsillitis, and are most severe when the inflammation is about to lead to the formation of an abscess. In persons, however, who are subject to the malady the fever seldom runs high. In those of debilitated constitution the fever occasionally assumes a typhoid character, whilst the local affection after a few days subsides into a subacute form, in which the tonsils are partially covered with an ashy exudation, or honeycombed with ragged and indolent ulcerations. These local phenomena are most apt to occur when the lacunæ of the glands are blocked up by caseous matter or calcareous formations. In the ordinary run of cases, as the disease develops, the tonsil becomes so much swollen as nearly to block up the isthmus of the throat, and to fill almost the whole pharyngeal cavity, rendering deglutition so extremely painful and difficult that the patient is afraid to swallow nutriment even in the liquid form. In follicular tonsillitis the swelling of the tonsils is less considerable, but the mucous membrane is of a very bright red color, and the follicles exude a white secretion, which slightly adheres to the point of exit, and gives the patient who examines his own throat the idea that he has several ulcers. In parenchymatous tonsillitis, there is not only great congestion and increase in size of the tonsils, but all the adjacent parts of the pharynx and palate may be seen to participate in the morbid action. A thick mucous secretion and a viscid saliva clog the mouth and throat of the sufferer, and respiration may be somewhat impeded. The voice acquires a nasal intonation, or is reduced to a mere whisper, the mouth can scarcely be opened, the head is moved with difficulty, owing to the swelling of the deep tissues of the neck, and the breath is intolerably fetid. Under these circumstances it is often difficult, and sometimes impossible, to get a view of the inflamed tonsils. In many cases—especially in the follicular form of the affection—after the disease has lasted two or three days the pharynx becomes covered with a layer of dirty, yellowish mucus, which bears some general resemblance to the false membrane of diphtheria, and has sometimes led to an error in diagnosis. The mucous secretion, however, which covers the tonsils in quinsy, possesses neither texture nor adherency, and can easily be wiped off the surface of the glands.

Velpeau [1] and Béraud have observed instances in which the inflammation extended through the cellular tissue of the neck as far down as the clavicle; whilst Morgagni [2] and MM. Rilliet and Barthez [3] report cases in which tonsillitis terminated fatally by suffocation. In almost all severe attacks of quinsy the hearing is affected, and occasionally the extension of the disease up the Eustachian tube gives rise to inflammation of the middle ear.[4] Œdema of the glottis is also a complication of quinsy, but happily a rare one; the inflammation, however, more frequently extends to the epiglottis [5] and the base of the tongue.

Follicular tonsillitis usually undergoes spontaneous resolution in three

[1] Manuel d'Anat. Chirurg., Paris, 1862. The authors demonstrate the continuity of the areolar tissue covering the tonsil with the general areolar tissue of the neck.

[2] De sed. et Caus. Morb., epist. xliv.

[3] Traité des Mal. des Enfants, 1853, vol. i. p. 227.

[4] Follin: Gazette Hebdomadaire, 1864, p. 155.

[5] Louis: Bulletin de Thérap., 1843.

or four days, but in parenchymatous inflammation or abscess of the tonsil a healthy condition of the parts is not generally re-established for ten days or a fortnight, and the disease may even be protracted for three or four weeks. Slight ulceration of the tonsils nearly always remains when the inflammation has caused the extrusion of inspissated cheesy matter or calcareous concretions which had previously blocked up the lacunæ of the glands. Occasionally a number of small superficial abscesses or pustules form on the surface of the tonsils, and these abscesses on discharging themselves give rise to ulcerations which, in cachectic persons, are very obstinate in healing. Gangrene is a very rare termination in tonsillitis, but may happen as a consequence of the highest degree of parenchymatous inflammation. Cases have been seen by Grisolle,[1] Trousseau,[2] Frank,[3] and especially by Borsieri,[4] according to whom the phenomena of such an issue are a sudden diminution of pain and dysphagia, the appearance of a bluish patch on the tonsil, and after a day or two the expectoration of a putrid, sanious matter, having a peculiar odor, which Borsieri thinks pathognomonic of the occurrence. I have never met with such a case. When tonsillitis proceeds to suppuration, the patient usually complains of lancinating pains in the part, and well-marked rigors generally precede the formation of an abscess. It is unusual for both tonsils to become the seat of an abscess, but when such an occurrence does take place, suppuration very rarely occurs in both glands simultaneously. One gland becomes affected after the other has suppurated, and the inflammation may terminate in abscess. As a rule, the pus shows a tendency to evacuate itself at the anterior part of the tonsil, and the abscess projects toward the mouth. Occasionally, however, it points near the posterior wall of the pharynx, and under extremely rare conditions may make an opening for itself externally at the angle of the jaw. If the abscess be not opened by the surgeon and do not burst spontaneously, it may occasion so much swelling internally as to interfere seriously with respiration. Professor Stoerk [5] has pointed out that fluctuation may often be detected at a very early period by placing the fingers of one hand below and behind the ramus of the lower jaw, and pressing the soft tissues inward, whilst the index finger of the other hand is introduced into the mouth and placed in contact with the inflamed part. In some cases the pus has been known to burrow through the cellular tissue of the neck as low down as the upper surface of the clavicle.[6] In a case reported by Montague,[7] the quantity of matter was so great that the patient, a young soldier, was suffocated by the sudden bursting of the abscess. At the post-mortem examination the larynx and the upper part of the trachea and œsophagus were found filled with pus. Such an accident as the foregoing is most to be dreaded should the abscess burst during sleep. A curious case is recorded by Roche,[8] in which the pus from a tonsillar abscess passed along the course of the great vessels of the neck and penetrated into the chest. Abscess of the tonsil is also dangerous on account of the external face of the gland being in close proximity to

[1] Traité de Pathologie Interne, t. i. Art. Amygdalite, 1862.
[2] Clinique Méd. de l'Hôtel-Dieu, Paris, 1865, 2d ed. t. i. p. 392.
[3] Traité de Médecine Pratique, trad. de Double, 1842, vol. i. p. 114, vol. ii. p. 164.
[4] De Angina, Institutiones de Méd. Prat., 1798, t. iii. p. 343.
[5] Klinik der Krankheiten des Kehlkopfs, Enke, Stuttgart, 1876, p. 109.
[6] Velpeau : Loc. cit.
[7] Dissert. de Anginâ Tonsillari, &c., Strasbourg, 1823.
[8] Dict. de Méd. et de Chirurg., Art. Amygdalite, 1829.

the internal carotid artery. After middle life, according to Chassaignac,[1] the artery in this situation describes a curve with the convexity directed inward which brings it still closer to the tonsil. Grisolle[2] mentions a case in which the abscess gave rise to ulceration of this vessel, and thus to serious hemorrhage; whilst Caytan,[3] Müller,[4] Norton,[5] and others report similar instances which led to an immediately fatal result. Chronic enlargement often remains after the acute inflammation of the glands has passed away.

Paralysis of the pharynx and palate, with or without anæsthesia, somewhat similar to that which so often follows diphtheria, is also an occasional consequence of a severe attack of quinsy.[6] It is a rare condition, and when present is generally limited to the side of the throat which has been the seat of the tonsillitis. Paralysis of the pharynx is indicated by a difficulty in articulating those sounds which require the closure of the posterior nares, and by slight dysphagia, which is found to persist long after all the acute symptoms of the malady have subsided. The difficulty exists in making the first effort of deglutition, and can usually be overcome by a little resolution on the part of the patient. As soon as the bolus passes below the superior constrictor, it proceeds downward to the stomach without any further difficulty. When the soft palate is alone affected, and the rest of the pharynx escapes, the symptoms are less marked. There may be, however, slight difficulty in swallowing—especially fluids, and nasal intonation of the voice. These palsies are, however, such rare sequelæ of quinsy that it is scarcely necessary to refer to them except as possible results.

Pathology.—As tonsillitis so rarely proves fatal, few opportunities have occurred where the pathologist could demonstrate the precise effects of acute inflammation on these glands. When the morbid action is superficial the mucous membrane, which covers the tonsils and dips into the lacunæ, is almost the only structure affected. In cases of parenchymatous inflammation, however, a much more important series of phenomena may be observed. Thus, in an instance recorded by Didelot,[7] the autopsy revealed extensive suppuration in the substance of the right tonsil, whilst the uvula was œdematous, and the mucous membrane of the palate infiltrated with pus. In addition, the base of the tongue was thickened and engorged, the follicles being filled with a concrete sebaceous matter, and a section of the organ showing effusion of pus between the muscles. In the case of Montague, already referred to, inflammation and thickening of the walls of the internal jugular vein and its branches were found at the post-mortem examination. Pus and clots were also present in the interior of these vessels, which accounted for the engorgement observed in the submaxillary and parotid glands and the neighboring lymphatics.

The tonsils often remain persistently enlarged after an attack of tonsillitis—the result of thickening and induration of the parenchyma of the gland.

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[1] Leçons sur l'Hypertrophie des Amygdales, Paris, 1854, p. 7.

[2] Traité de Pathol. Interne, Paris, 1862, t. i. p. 269.

[3] Prager Vierteljahrsschrift, 1861.

[4] Wurtemberger Med. Corresp. Blatt., 1855.

[5] The Throat and Larynx, London, 1875, p. 12. Mr. Norton's patient was a little girl æt. four.

[6] See cases by Maingault: Sur la Paralysie du Voile du Palais à la Suite d'Angine, Paris, 1853; Gubler: Mémoires sur les Paralysies, &c.; Archiv. de Méd., 1860–61.

[7] De l'Amygdalite Aigue—Thèse de Paris, 1850, No. 153.

Diagnosis.—The diagnosis of tonsillitis presents little difficulty. Nevertheless mistakes are frequently made, and the high mortality attributed to this disease in the annual returns of the Registrar-General, to be hereafter referred to, must be due to this cause. I have twice been consulted in cases of tonsillitis mistaken for laryngitis. In both affections there may be pain in swallowing, but when the larynx is the seat of inflammation the voice almost always becomes hoarse or is reduced to a mere whisper at an early period of the attack. In the laryngeal disease inspection of the pharynx at once shows the absence of any lesion in the upper part of the throat, whilst the laryngoscope reveals the actual condition of the larynx. Some discrimination is required in order to distinguish the sore throat of the first stage of scarlet fever from tonsillitis. Even hydrophobia has been mistaken at its outset for quinsy. The whitish follicular secretion, which often veils the tonsils in tonsillitis, has caused the affection to be mistaken for diphtheria, and has led to the supposition that the more serious disease has been cured by some simple measures. In all cases it is well to suspend the judgment for twenty-four hours, after which time the divergence of symptoms in any of the maladies which simulate quinsy is so apparent that the careful observer can usually arrive at a positive decision.

Prognosis.—The prognosis as regards life is so seldom unfavorable that the rare cases which terminate fatally must be viewed as merely accidental.[1] It is well, however, to bear in mind the possibility of such casualties in order to foresee and obviate them when the symptoms announce the advent of grave complications. With respect to complete recovery the prognosis in tonsillitis is not always favorable, though it usually is so in patients of sound constitution. In debilitated persons there is great probability of hypertrophy and chronic inflammation of the tonsils remaining after a severe quinsy. A liability to frequent subsequent attacks is also one of the most troublesome after-consequences of this disease.

Treatment.—The *superficial* forms of tonsillitis generally undergo spontaneous resolution in two to five days, and call for little treatment beyond such simple measures as confinement to the house, a light diet, and a dose or two of some mild aperient. A rhatany lozenge (Throat Hosp. Phar.), taken every three or four hours, will also materially hasten the cure of the disease. In cases of *deep tonsillitis* the treatment required is much more active, but fortunately there is a remedy which, if administered at the outset of the attack, will almost always cut short the crescent inflammation. This is guaiacum. Dr. Home,[2] who well remarked, *instar specifici in hoc morbo operatur*, did not at all overstate the influence of the drug. It was formerly much given for this complaint in the form of the ammoniated tincture, but fifteen years ago Dr. Crompton, of Manchester, recommended me to try it as a powder. Taken in this way it seems to

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[1] According to the Registrar-General's Returns, 226 persons died of quinsy in England in 1875, and the number has varied between 110 and 569 every year since 1848, except in the year 1858, when 623 deaths were returned. It is well to bear in mind that in that year diphtheria attained great epidemic force, whilst it was still but little understood and sometimes altogether unrecognized. The mortality returns gradually decreased from that time, and fell as low as 110 in 1872. It is scarcely necessary to point out that these returns are the results of errors in diagnosis, and it is a matter of regret to find that lately there has been a slight increase in the returns. Thus in 1873 the reported deaths were 158; in 1874, 173; and in 1875, 226!

[2] Principia Medicinæ, part iii. sec. 4.

have a local as well as constitutional effect. Soon after I prescribed it as a lozenge, and it is now largely used in that form. A lozenge containing three grains of the resin (Throat Hosp. Phar.), given every two hours, will seldom fail to arrest the disease at its first onset. Tincture of aconite in doses of two to five minims every three hours is sometimes very efficacious. This remedy, for which we are in a great measure indebted to homœopathy, has been strongly recommended by Dr. Ringer,[1] who advises that half a drop or a drop of the tincture, in a teaspoonful of water, should be given every ten minutes or quarter of an hour for two hours—and afterward hourly. According to Dr. Ringer, a high temperature both affords the indication for the administration, and assures the success, of this remedy. In my hands this drug, however, has not proved so useful as guaiacum. When the disease is not seen at the commencement, the above remedies will fail to shorten its course, but the constant sucking of ice may still sometimes prevent the further development of the attack. We must also have recourse to such general therapeutic measures as are calculated to guide the morbid action to a favorable issue. The bowels should be kept open, the diet should consist entirely of nutritious soups, milk, etc., whilst locally, mildly astringent or sedative gargles of tannin, borax, opium, etc., may sometimes be used with advantage. The immediate sensations of the patient are the best guide as to the use of the different kinds of gargles, or, indeed, as to the employment of gargles at all. Sometimes they cause great pain, and should not then be used. A dose of Dover's powder at bedtime is also very beneficial when there is much fever and vascular excitement. Some practitioners have confidence in the direct application of mineral astringents, and Velpeau[2] especially recommends powdered alum and nitrate of silver. The pigment of chloride of zinc (Throat Hosp. Phar.), brushed over the inflamed tonsils two or three times a day, is sometimes productive of great benefit, and even less frequent applications often do good. I quite agree with Trousseau, however, that there are certain cases in which the inflammation inevitably leads to suppuration, and that in these cases all remedies are powerless to turn it from its path. The morbid action marches onward, unchecked in its course, until the formation and discharge of pus announces the completion of the process. In these cases of *tonsillitis with abscess* the best endeavors of the medical attendant should be directed to encouraging suppuration and shortening the stages of the disease. With this view a constant succession of warm poultices should be kept applied to the throat, while the patient should make persevering use of hot inhalations of steam to which some sedative, such as benzoin, hop, or conium (Throat Hosp. Phar.) may be added, and he should also gargle frequently with warm water. As soon as pus has formed, it is better to open the abscess at once than to leave it to evacuate itself spontaneously. The incision should be made with the pharyngeal bistoury, the point and cutting edge of the knife being directed upward and inward toward the median line. In the case of very nervous persons who are afraid of the knife, the immediate rupture of the abscess may often be attained by the administration of an emetic. Once the matter is evacuated, relief is generally almost instantaneous, though convalescence may occasionally be retarded in those of feeble organization. On this account it is always important to sustain the constitutional powers as far as possible.

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[1] A Handbook of Therapeutics, London, 1872, p. 385.
[2] Op. cit. t. 1. p. 453.

Formerly the abstraction of blood, either general or local, was the primary treatment in all cases. The researches of Louis,[1] however, proved how little benefit may be expected from general bleeding. Thus, out of twenty-three patients suffering from parenchymatous tonsillitis noted by that observer, thirteen underwent venesection and ten were treated by other methods. The duration of the disease in the former cases was, on an average, nine days, whilst in the latter it was ten and a quarter days. This slight abridgment of the course of the malady cannot therefore be considered to compensate for such energetic interference. With respect to local bleeding it has been recommended to apply leeches at the angle of the jaw or to scarify the tonsils with the pharyngeal bistoury. If only one or two leeches are applied to each side, the effect appears to be the opposite to that desired, and an increased congestion of the tonsils often results. The good effect of the local abstraction of blood can only be obtained by the application of from three to six leeches on either side. A special kind of local bloodletting, *i. e.*, opening of the ranine veins, has within the last twenty years been practised to a considerable extent, and much vaunted in certain parts of France. The principal advocates of this measure, which is as old as Hippocrates, are MM. Arago[2] and Aran.[3] The latter writer insists on the incision being made longitudinally in the veins in order to avoid wounding the ranine arteries, an accident which, on account of the serious hemorrhage it entails, would be likely to bring this kind of bleeding into disrepute. Although I have never seen any cases in which such heroic remedies were called for, the proceeding certainly appears to have been attended with remarkable success in the hands of Aran.

In cases where the swelling of the tonsils is so great as to threaten suffocation, and where it cannot be diminished by the escape of pus, we must follow the example of Ancelon,[4] and at once excise the inflamed masses. In the middle ages tracheotomy was suggested in such a juncture, but the operation was not actually performed under these circumstances until the last century. In a recent instance, related by Puech,[5] of a man æt. 33, who was evidently dying from asphyxia, and on whom the attempt to excise the tonsils had failed, recourse was had to tracheotomy with the result of saving the life of the patient. Tracheotomy was also performed by Mr. Alexander Shaw[6] under similar circumstances.

Should tonsillitis terminate in gangrene, treatment by antiseptic gargles will be sufficient until the sphacelated portions of the tonsil become detached, when the raw surfaces remaining will usually heal rapidly under applications of nitrate of silver.

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[1] Lancette Française, 1833.
[2] Bulletin Général de Thérapie, &c., 1853. Also Mestivier, Ibid. 1857.
[3] Ibid. 1857.
[4] Gazette des Hôpitaux, 1857.
[5] Gazette Hebdomadaire, 1857, p. 592.
[6] Medical Gazette, 1841, p. 190.

ENLARGED TONSILS.

Latin Eq.—Tonsillæ intumescentes.
French Eq.—Hypertrophie des amygdales.
German Eq.—Hypertrophie der Tonsillen.
Italian Eq.—Tonsille ipertrofiche.

Definition.—Chronic inflammation of the tonsils, giving rise to persistent enlargement and multiplication of the constituent structures of the diseased part, and to impairment of the functions of the glands.

Etiology.—Hypertrophy of the tonsils is sometimes congenital, and is often met with in the first months of life. The affections so common in infants, such as purulent ophthalmia, eczema and impetigo of the face and scalp, nasal discharges, etc., are probably the exciting causes in the earliest months of existence. The disease not unfrequently becomes developed for the first time about the age of puberty, owing, as some suppose, to a sympathetic connection between the sexual organs and the tonsils.[1] The following table[2] contains an analysis of the ages of 1,000 patients seen by me at the Hospital for Diseases of the Throat:

1 to 5..... 84 5 to 10..... 181	Under 10 years.....	265
	From 10 to 20 years.....	382
	20 to 30 "	219
	30 to 40 "	103
	40 to 50 "	27
	50 to 60 "	3
	60 to 70 "	1

Probably many of the cases in the earliest period were either congenital or made their appearance very soon after birth.

Sex is not without some influence in producing the affection, for out of the 1,000 instances recorded in the preceding table, 673 were males and 327 females. Some cases of hypertrophy of the tonsils result from an attack of quinsy, but a cachectic state of the constitution, especially if due to the strumous diathesis, more often originates the disease. The morbid condition of the glands may frequently be observed to date from a severe attack of scarlatina, measles, or small-pox with throat complications; and Lambron[3] mentions four instances in which the malady was consequent on an attack of diphtheria. Syphilis, hereditary or acquired, is also capable of producing chronic inflammation of the tonsils, and granular pharynx[4] is, in some instances, the immediate cause of the malady. Chassaignac[5] mentions a case of nasal polypus which appeared to have had some effect in giving rise to tonsillar enlargement. As a rule, hypertrophy of the tonsils, by whatever influence established, tends toward a

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[1] Crisp and Headland: Dublin Medical Press, 1849, vol. xx. p. 229; and Prosser James: Med. Times and Gaz., Sept. 1859.

[2] See also Chassaignac: Leçons sur l'Hypertrophie des Amygdales, Paris, 1854.

[3] Bulletin de l'Acad. de Méd., 1861

[4] Guéneau de Mussy: Op. cit.

[5] Op. cit. p. 11.

spontaneous cure after the age of thirty, and subsequently to that period of life the volume of the glands diminishes so steadily and constantly that the decade of from forty to fifty affords few instances of the disease.

Symptoms.—We can often predicate the existence of enlarged tonsils as the child, with its open mouth, drooping eyelids, dull expression, and thick voice, enters the consulting-room. On looking into the pharynx we can generally at once perceive the hypertrophied tonsils, and in some cases they are seen meeting each other in the middle line of the pharynx, and entirely concealing from view its posterior wall. The augmentation of volume of the tonsils varies in different cases. They are often the size of a chestnut, but sometimes attain the dimensions of a bantam's egg, and in rare instances they are nearly as large as hens' eggs. The disease generally affects both tonsils, but one gland is nearly always more enlarged than the other.

Sometimes the tonsils are only slightly enlarged, but the jagged surface and dilated lacunæ present a *honeycombed* appearance, and render them very prone to inflammation.

Any considerable degree of enlargement of the tonsils gives rise to some difficulty in respiration, and there is generally noisy breathing—often snoring—during sleep. As the posterior nares and naso-pharyngeal cavity are more or less cut off from the lower part of the pharynx by the enlarged glands, respiration through the nose cannot be carried on with sufficient freedom, and the patient is consequently obliged to keep his mouth constantly open. In swallowing, he sometimes experiences the sensation of a foreign body in the throat, and occasionally there is a difficulty in opening the mouth, owing to the enlarged tonsils interfering with the movements of the angle of the jaw. In infants, enlarged tonsils often interfere with sucking.

Attention has already been called to the facial expression of children afflicted with enlarged tonsils, but it may be remarked that the peculiarities of physiognomy are the results of the profound impress which the disease exercises on the whole system. The phenomena are mainly due to the mechanical effects of the enlarged glands in obstructing respiration. The simplest and most common of the mechanical effects of enlarged tonsils is, however, the alteration which the voice undergoes. The cavities of the pharynx and nose, which form as it were the sounding-board for the vibrations set in motion by the vocal cords, have their functions in this respect more or less destroyed, the voice partakes of a nasal intonation, and the speech becomes thick and guttural. The defect in articulation is especially noticeable in the case of children between the ages of six and twelve in whom the hypertrophy is excessive.

Interference with the sense of hearing—in some cases amounting to almost complete deafness—is a frequent concomitant of hypertrophy of the tonsils. It was at one time supposed that compression of the orifice of the Eustachian tube played the principal part in the production of "throat deafness,"[1] but the observations of the late Mr. Harvey[2] tend to prove that the increase in the size of the tonsil proceeds in the direction of the mouth, and that as the tonsil enlarges the Eustachian aperture becomes more patent than in the normal state. He therefore attributed this form of cophosis to chronic swelling and congestion of the mucous

[1] Chassaignac: Op. cit. p. 37 et seq.

[2] The Ear in Health and Disease, London, 1865, p. 162; and The Enlarged Tonsil, &c., London, 1850, p. 21 et seq.

membrane of the Eustachian tube, and recent[1] researches have shown that one of its chief causes is pressure of Luschka's tonsil on the posterior lip of the Eustachian orifice.

Of all the evil results attendant on hypertrophy of the tonsils, those due to interference of the diseased masses with free respiration are the most serious. The partial occlusion of the nasal channel posteriorly by the enlarged tonsils, obliging the patient to keep the mouth almost constantly open, renders him unusually exposed to all the external influences which produce inflammatory affections of the respiratory tract, whilst the persistent obstruction to respiration leads to serious changes in the thoracic parietes. In 1828, Dupuytren[2] called attention to the frequency with which deformity of the walls of the chest was found associated with hypertrophy of the tonsils, without, however, signalling anything besides a mere coincidence between the two phenomena. He described the modifications in the shape of the thorax as consisting in narrowing of the anterior superficies, bulging out of the back, and flattening on both sides, but these changes are more characteristic of rachitic disease. Subsequently, this subject was still further investigated by several observers, but principally by Mason Warren,[3] Shaw,[4] Robert,[5] and Lambron.[6] Mr. Shaw called attention to the frequent association of enlarged tonsils and the so-called "pigeon-breast," whilst to Lambron is due the credit of having most accurately noted the various morbid changes, and of having explained their causation in a thoroughly rational manner. According to Lambron, the characteristic malformation of the thoracic cavity met with in cases of enlarged tonsils, is a circular depression of the walls of the chest at about the junction of the lower and middle third. The thorax seems as if it had been confined by an unyielding ring which, while contracting its growth in this situation, gives an appearance of abnormal bulging to the upper part of the cavity. This circular depression corresponds with the attachment of the diaphragm internally to the osseous framework of the chest, and is evidently due to the constant energetic contractions of that muscle to overcome the obstacle to free respiration. In childhood the bones yield easily to such influences, and any one who has witnessed the difficulty of breathing which occurs, especially during sleep, where there is any considerable hypertrophy of the tonsils, will readily understand how pernicious may be its effects on the respiratory apparatus. In addition to the organic alterations in the bones of the chest, other evils are brought about, and Chassaignac[7] well observes that although increased efforts of the diaphragm, to a certain extent, neutralize the impediment to respiration, there are frequent intervals when the powers of the muscle become temporarily exhausted, and the oxygenation of the blood is very incompletely performed. The vital forces are in consequence very much lowered, the patient lives in a state of permanent ill-health, and easily succumbs to any acute attack of disease, particularly if affecting the respiratory organs.

Besides the various phenomena attendant on hypertrophied tonsils, as detailed above, Chassaignac[8] mentions several cases to illustrate the evil

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[1] Michel: Krankheiten der Nasenhöhle, &c., Berlin, 1876, p. 102 et seq.
[2] Répert. d'Anat. et de Physiol., 1828, t. v.
[3] Philadelphia Medical Examiner, May, 1838.
[4] Medical Gazette, October 29, 1841, p. 187 et seq.
[5] Bulletin Général de Thérapie Medicale, &c., 1843.
[6] Loc. cit. [7] Op. cit. p. 30. [8] Ibid.

effects of the disease on the brain, the digestive organs, and on the senses of sight, taste, and smell. He thinks that the local pressure of the enlarged glands diminishes the supply of blood to the brain, and impedes its return; whilst the digestive organs suffer when there is difficulty of swallowing, and also when the diseased tonsils discharge putrid matters which find their way into the stomach. With respect to smell and taste, I have often observed that these senses are more or less defective in the subjects of enlarged tonsils, if the condition has existed for any length of time. As regards sight, however, I have not met with any cases in which I could trace any clear connection between affections of the eye or modifications of vision and enlarged tonsils.

Pathology.—The diseased condition is a true hypertrophy, a veritable hyperplasia, in which the volume of the glands is not only increased, but increased by a multiplication of all their constituent tissues and follicles.[1] According to Chassaignac[2] the limit of weight of the enucleated tonsil in the cases which he examined was from three grammes two centigrammes to seven grammes fifty centigrammes. The epithelium does not usually show much alteration, but the papillæ beneath are often more numerous and less elevated than in the normal state. On making a section of an enlarged tonsil, in some instances the structures will be found to cut with a creaking noise, owing to thickening and induration of the connective tissue, whilst at other times the substance of the diseased gland is found to be characterized by softness and friability. The color of the cut surface may vary from a dusky red to a dirty yellow hue. The lacunæ are seen to be dilated, and to have their walls thickened; whilst their cavities are filled with a viscid mucus, which in some cases becomes consolidated into matter of a caseous or even calcareous consistence. Around the lacunæ are congregated the follicles of the tonsil, which are always increased in size and generally in number. The capsule[3] of the tonsil is also generally thickened and indurated, and the lymphatic glands of the jaw are in many cases considerably enlarged.[4]

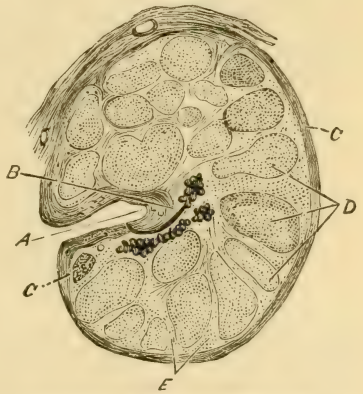

FIG. 9.—Section of the healthy tonsil. A, hilus; B, mucous gland; C, epithelial covering; D, lymphatic follicles; E, stroma.

Diagnosis.—But little need be said on this point. It is only necessary to examine the pharynx in order to perceive the increased size, and often the diseased surface, of the tonsils. In some cases the tonsils, though actually but slightly increased in dimension, seem to have undergone great enlargement, owing to their being rotated forward and inward toward the median line.[5] In this way they present their internal surfaces anteriorly and, stretching across the front of the pharynx, closely approach each other. In some persons this movement, which is semi-involuntary, occurs to a much greater degree than in others, and in such

[1] Virchow: Krankhaften Geschwülste, vol. ii. p. 612. [2] Op. cit. p. 13.
[3] Chassaignac: Op. cit. p. 7.
[4] Griesinger: Archiv. f. Phys. Heilkunde, vol. iv. p. 515.
[5] Chassaignac: Op. cit. p. 8.

cases the peculiarity is at once seen if a disposition to retching is artificially produced. If, however, the patient be told to open his mouth and inspire deeply, the normal position of the parts will be generally retained. At other times the tonsils, although much hypertrophied, are yet almost hidden behind the pillars of the fauces.[1] This condition can easily be diagnosed by placing the first finger of one hand on the internal surface of the tonsil, and that of the other hand externally just behind the angle of the jaw, when an accurate estimate of the proportions of the gland can at once be arrived at. A little familiarity with the usual conformation of the pharynx will prevent either of these appearances leading the observer into error. It may be remarked that retro-pharyngeal abscess has sometimes been mistaken for enlargement of the tonsils.

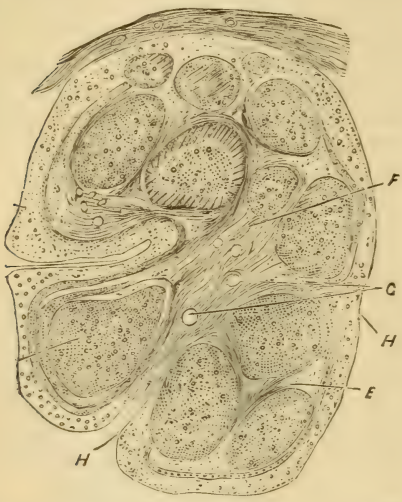

FIG. 10.—Section of the enlarged tonsil. A, hilus; C, epithelial covering; D, lymphatic follicles; E, stroma; F, increased connective tissue of stroma: G, enlarged vessels; H, slight interruption of the epithelial covering.

This woodcut is a slightly schematic illustration made by Dr. Stephen Mackenzie from sections of a diseased tonsil removed by the author, and shows the appearances usually observed on microscopic examination. The laminated epithelial covering is a good deal thickened. At H, the epithelium has given way, probably owing to suppuration and rupture of some subjacent lymphatic follicles. Beneath the epithelium the mucosa is seen to be increased by the extra development of lymphatic cells, some of which in places insinuate themselves between the epithelial cells. The lymphatic follicles are enlarged, and the distinction between the follicles and surrounding lymphatic tissue in places obscure. No distinct caseation is shown in the drawing—none having been present in the case from which it was made. The lymphoid cells of the follicles are packed closely together, and some of the cells are large and pale. In many cases the follicles are much more numerous than in the illustration, and are arranged in rows perpendicular to the surface. The connective tissue is largely increased, and contains much larger vessels than seen in the healthy condition. The acinous mucous glands naturally present in the tonsil have disappeared.

Prognosis.—Hypertrophy of the tonsils occasionally exists in the adult—and even in children—without giving rise to any inconvenience or evil effects. Such cases are, however, quite exceptional, and in early life especially the disease is one which almost always requires immediate attention. The enlarged tonsils sometimes spontaneously regain their normal dimensions about the age of puberty, but by that time the morbid condition may have seriously impaired the general health of the patient. When the hypertrophy takes place in adult life, it is seldom productive of any evil consequences, except in so far as it occasions local inconvenience. Should the bodily powers, however, be feeble, the constitution is likely to suffer, and in any case the disease becomes important when, as is often the case, the gland is frequently attacked by slight inflammation. It is well, however, to remember that after the age of thirty a progressive diminution in the size of the tonsils, and a gradual cessation of all the troublesome symptoms, are almost certain to take place.

Treatment.—The various measures for reducing hypertrophy of the tonsils may be conveniently divided into *local*, *constitutional*, and *operative*.

Local treatment consists in the application of remedies to the tonsils

[1] Guersant: Hypertrophie des Amygdales, Paris, 1864.

in order to effect a diminution of their volume. When the enlargement is slight, and in a great measure due to irregular thickening of the mucous membrane covering the tonsils, and to dilatation of the lacunæ, producing the *honeycombed* appearance already described, astringent preparations are often productive of decided benefit; but such agents never cause any considerable reduction of the gland structure. The most effective astringents in such cases are perchloride of iron in solution, and alum or tannin in powder. A solution of perchloride of iron (℥ j. to ℥ ij. ad ℥ j.) may be painted over the tonsils once or even twice daily with a brush. Finely powdered alum or tannin can be effectually applied by means of the pharyngeal spatula. The extremity of the spatula should be slightly moistened in order that a coating of the powder may adhere to it, and the remedy should then be well rubbed into the surface of the tonsil. This plan answers better than applying the powder with an insufflator. The application ought not to be made more than once a day. Tincture of iodine painted over the tonsils has often been recommended, but has little effect in resolving the hypertrophy. The solid stick of lunar caustic has also been loudly vaunted, but it seldom materially lessens the bulk, or improves the pathological condition, of the glands. When the glands are really hypertrophied the remedy must be of a destructive character, and escharotics must be used. In my hands the London paste (Throat Hosp. Phar.) has succeeded far beyond any other remedies of this kind, and has indeed, in many instances, precluded the necessity for excision of diseased tonsils. Its method of application has already been described (page 28). The application may be repeated once or twice a week, according to circumstances, on different parts of the surface of the tonsil. On each occasion the result is a slough, and a large amount of the diseased mass may thus be destroyed in successive layers, until the glands have been reduced to a normal volume, or at least to such a size as to cease to give rise to troublesome symptoms. It must be confessed, however, that the treatment is tedious, and that the guillotine affords a quicker method of effecting a complete cure. I have treated a few cases successfully by parenchymatous injections of dilute acetic acid (Brit. Phar.) with a curved syringe, but the treatment is slightly painful. From ten to fifteen injections were used in each case. Dr. Solis Cohen[1] has reduced the enlarged glands by electrolysis—from ten to twenty operations having been required in each case.

Constitutional Treatment.—Whilst any of the measures detailed above are being carried out, internal remedies should be administered in order to improve the general health, or to combat the morbid diathesis which may be present. With this view the diet should be as nutritious as possible, and the patient should be treated with special drugs or general tonics, such as iodide of potassium, cod-liver oil, and phosphate of iron, etc., according to the circumstances of the case. Lambron[2] speaks highly of the effects of sulphurous waters (Bagnères-de-Luchon). The patient drinks and bathes in the waters, has them applied directly to the pharynx and neck by means of a douche used daily for five to fifteen minutes, and employs spray inhalations. Dr. Lambron states that the general health is always much improved by a course of these mineral waters, whilst in very many cases the tonsillar hypertrophy undergoes resolution, and the glands are almost reduced to their normal size.

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[1] Diseases of the Throat, New York, 1872, p. 132. [2] Op. cit.

Operative treatment consists in the removal of a portion of the tonsils by abscission.

Extirpation of the Tonsils.—This operation must have been commonly practised at a very early period, for although the first clear mention of it is made by Celsus [1]—A.D. 10—he speaks of excising the tonsils with such familiarity that it was evidently considered a very ordinary and trifling procedure. He observes:—"Tonsils which remain indurated after inflammation, if covered by a thin membrane, should be loosened by working the finger round them, and then torn out; but when this is not practicable they should be seized by a hook and excised with a scalpel." Ætius [2]—A.D. 490—the next writer who gives an account of the operation, speaks of it in much more cautious terms. "The portion," he remarks, "which projects—*i. e.*, about one-half of the enlarged gland—may be removed. Those who extirpate the entire tonsil remove at the same time structures which are perfectly healthy, and in this way give rise to serious hemorrhage." Paulus Ægineta [3]—A.D. 750—instructs us as to excision of the tonsils very precisely. He does not approve of operating on them when inflamed, and describes them as being most fit for removal when they are "white, contracted, and have a narrow base." The head of the patient is held, and his tongue pressed down with a spatula by assistants, and, the tonsil being seized and drawn outward by a tenaculum, is "cut out by the root." Albucasis [4]—A.D. 1120—evidently takes Paul of Ægina for his preceptor, and gives almost the same directions for performing the operation. He is, however, more cautious in his advice, dreads hemorrhage, and fears to excise the tonsils unless when they are "round, whitish, and have a narrow base." Subsequently to this period the operation appears to have fallen into disuse, and having become almost obsolete and traditionary, succeeding writers either omit all mention of it, or approach the subject with such timidity as to show that they had had no personal experience. Thus even the zealous and indefatigable Ambroise Paré [5]—1509—counsels tracheotomy when serious enlargement of the tonsils exists, and gives a hint also as to ligaturing the hypertrophied glands, but makes no remark as to their excision. Fabricius, of Acquapendente [6]—1540—makes some comments on the instructions of Celsus and Paul of Ægina, and comes to the following puerile conclusion:—"Whence we can perceive that this surgical procedure is neither easy nor altogether safe. Wishing that all violence should be avoided in this operation, we should, therefore, advise a trial to be first made to loosen the tonsil from the surrounding structures with a vectis, and then, having laid hold of it with a very slender vulsellum, to pull it outward in order that the gland may come away almost of its own accord." Guillemeau,[7] the pupil of Ambroise Paré, advocates a bolder surgical treatment of the tonsils than did his master, and does not resort to tracheotomy unless the patient's mouth cannot be opened. According to circumstances, he ligatured or cut away the diseased masses, and he is opposed to the removal of the entire tonsil. In 1637 Severini,[8] during an epidemic at Naples, the

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[1] De Medicina, cap. vii. sect. 12.
[2] Βιβλία Ἰατρικὰ Ἑκκαίδεκα, Venice, 1534, cap. ii. sect. 36.
[3] New Sydenham Society's Translations, vol. ii. p. 297.
[4] Al-Tasriff. Oxford, 1778, cap. ii. sect. 36.
[5] Œuvres Complétes, Edit. Malgaigne, Paris, 1840, t. i. p. 383.
[6] Opera Chirurgica, Lugduni Batavorum, 1723, col. 461–2.
[7] Les Œuvres de Chirurgie de Jacques Guillemeau. Paris, 1612, p. 688.
[8] Saint-Germain: Dict. de Méd. et de Chirurg. Prat., Paris, 1865, vol. ii. p. 156.

principal symptom of which consisted in great swelling of the tonsils, removed large portions of the glands, when sessile, by caustics, and, when pediculated, by means of a hook and a kind of a semicircular knife. Nevertheless, for a whole century afterward, excision of the tonsils was almost entirely discountenanced, although some few surgeons occasionally had recourse to the ligature. Dionis[1]—1672—opposes altogether the removal of the tonsils, whether by excision, evulsion, or ligature, and states that the glands have a physiological importance which completely precludes the advisability of wholly or partially taking them away. Juncker[2]—1680; Heister[3]—1683; and Sharp[4]—1688—a pupil of Cheselden—all fear to excise the tonsils, and condemn the operation, contenting themselves with feeble attempts to remove portions of the glands by ligature or cautery. The opinion of Heister is worth quoting, as his surgical treatise was, perhaps, the most popular text-book during the first half of the last century. "This operation," he observes, "is not only too severe and cruel, but also too difficult in the performance, to come into the practice of the moderns, because of the obscure situation of the tonsils. After 1740, however, the operation by means of the tenaculum and bistoury was again much practised, and the credit of the revival is principally due to Meseati[5] and Wiseman.[6] The practice of the latter surgeon was first to ligature the tonsil, and then to cut off the projecting portion. In 1757 Caqué[7] commenced to excise the tonsils at the Hôtel-Dieu of Rheims, and proved indisputably that the great dread which existed of hemorrhage was quite chimerical, and that the resulting wound readily healed in a short time. From this date excision of the tonsils became one of the recognized operations of surgery, and practitioners began to improve the instruments, and invent new methods for performing it. It is unnecessary to describe here all the various hooks, forceps, bistouries, etc., which were devised during the last century for the excision of the tonsils, as almost every eminent surgeon made some modification of the instruments used for the purpose by his predecessors or contemporaries. The method most generally in favor was, perhaps, that of Louis,[8] who employed a blunt-pointed bistoury or pair of scissors, the blade or blades being sometimes preferred curved and sometimes straight. The patient was placed with his face toward the light, and directed to open his mouth widely; an assistant then pressed down the tongue with his finger, or with a spatula, whilst the surgeon seized the tonsil with a vulsellum, and, drawing it as much as possible toward the median line, cut off the superfluous portion on a level with the pillars of the fauces. After a time the scissors gave way to the bistoury, and many surgeons still operate with the knife and forceps.

A description of the tonsillotome or guillotine, and the mode of using it, will be found under "Pharyngeal Instruments" (p. 9).

As regards the respective merits of operation by the tonsillotome, or by the bistoury and forceps, it is obvious that the former instrument

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[1] Cours d'Opérations de Chirurgie, Paris, 1714, p. 532.
[2] Conspectus Chirurgiæ tam Medicæ quam Instrumentalis. Halæ, 1721, p. 661.
[3] A General System of Surgery, London, 1768, vol. ii. p. 44.
[4] Surgical Operations, London, 1761, p. 189, 8th edition.
[5] Mém. de l'Acad. de Chir., t. v. Sur la rescission des amygdales tuméfiées.
[6] Eight Chirurgical Treatises, London, 1734, vol. ii. p. 30, 6th edition.
[7] Amygdalotomie, 1757.
[8] Mém. de l'Acad. Roy. de Chir., 1774, t. viii. p. 423: Sur la rescission des Amygdales.

ought to be used in all but exceptional cases. When the tonsils are only slightly and irregularly enlarged, or have calculi impacted in their substance, the bistoury and forceps may perhaps be more manageable; but in all ordinary cases the tonsillotome must be considered to be the instrument which modern surgical invention has succeeded in perfecting for its purpose.

In adults the tonsils occasionally attain such a magnitude that they cannot be encircled by the ring of the largest tonsillotome. This extreme hypertrophy generally takes place on one side only, and in such cases the wire *écraseur* should be employed. This operation, of course, occupies more time than when the tonsillotome is used, but is attended with little pain, and does not cause any hemorrhage.

Some practitioners are in the habit of giving large doses of bromide of potassium for several days before excising the tonsils. I have made an extensive trial of this drug, but cannot state, from my own experience, that I ever saw it produce any marked anæsthesia of the fauces. In nervous patients, however, especially children, the general action of the remedy, as a nervine sedative, may, perhaps, lessen the mental apprehension and nervous shock consequent on a surgical operation. With respect to the use of anæsthetics, such as chloroform, ether, nitrous oxide gas, etc., I think that they are wholly uncalled for. The actual operation seldom occupies more than ten or fifteen seconds, and in the rare event of there being any considerable hemorrhage it is well that the surgeon should have the active co-operation of the patient, in order to prevent the blood descending into the air-passages.

As regards hemorrhage following excision of the tonsils I have only once met with a case in which the bleeding appeared actually to endanger life—and this was before I had discovered the means of arresting tonsillar hemorrhage, which will be presently described. The experience of nearly all writers points to the rarity of any serious hemorrhage, but Velpeau[1] has reported four cases in which the internal carotid artery was laid open whilst a portion of the tonsil was being cut away with a bistoury, and a few years ago Mr. McCarthy successfully tied the common carotid artery at the London Hospital in the case of a patient suffering from continuous hemorrhage after excision of a tonsil. In the great majority of cases the bleeding soon ceases spontaneously, and it is only necessary to make the patient gargle and wash the throat with cold water for a few minutes. Occasionally a persistent oozing of blood follows the operation, but under these circumstances the tanno-gallic acid gargle of the Throat Hospital Pharmacopœia will at once arrest the hemorrhage. Half a teaspoonful of the remedy should be slowly sipped at short intervals. During the act of deglutition the styptic fluid is worked into the cut surface of the tonsil, and the hemorrhage is effectually restrained in all cases. In the worst instances the bleeding may recur again and again for a day or two, but it can at once be checked on each occasion by a prompt use of the tanno-gallic fluid. In most cases sucking ice[2] generally stops the hemorrhage. In extreme cases, when the internal carotid has been laid open, the common carotid must be ligatured.

With respect to the method proposed by Celsus, already referred to, of tearing out enlarged tonsils by the finger, it is worthy of notice that this method has been revived and practised with success by an Italian surgeon

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[1] Chassaignac, op. cit. p. 109.
[2] Med. Times and Gazette, 1860, p. 631

named Borelli.[1] He describes the proceeding as easy of execution, and devoid of risk from hemorrhage. "The index finger," he remarks, "is placed behind the summit of the gland, and by working from above downward with the nail, and making traction, the tonsil is detached from its bed. The organ can in this way be removed entire with much more ease than with the ordinary amygdalotome. A small piece, which does not afford a sufficient purchase to the finger in order to be torn away, is generally left at the inferior part. It only requires, however, to be seized with a forceps, when it can be separated by a slight movement of torsion."

Finally, as regards the after-treatment of the operation, it may be stated that the wound usually heals spontaneously in a week or ten days. It is, therefore, only necessary to confine the patient to the house for the first few days, and to direct him to avoid all hot, hard, and irritating articles of food. Marsh-mallow lozenges (Throat Hosp. Phar.) often give great relief by forming a coating over the wounded surface, and thus protecting it to some extent from the action of the ingesta. Occasionally the wound assumes an unhealthy aspect, and becomes covered with an ashy, aphthous exudation—sometimes almost membranous. This condition is most frequently seen when the hemorrhage has been more copious and persistent than usual. Under these circumstances if the solid nitrate of silver be lightly applied daily for two or three days, the cut surface will rapidly become a healthy ulcer. In other cases, when there is marked constitutional dyscrasia, the wound may be slow in healing, and give rise to great pain in swallowing. The discomfort can, however, always be relieved in a few days by the application of mineral astringents, such as the pigmenta of chloride of zinc or perchloride of iron (Throat Hosp. Phar.). In conclusion, the only other evil consequence of the operation that can be feared is traumatic inflammation of the pharynx. I have never met with a case of this kind, but an instance is mentioned by Liégeois[2] which resulted in œdema of the glottis and death. In the rare event of acute inflammation supervening, the practitioner should be guided by the rules which govern the treatment of traumatic pharyngitis.

FOREIGN BODIES IN THE TONSILS.

(Synonyms: Concretions. Calculi.)

Latin Eq.—Corpora adventitia in tonsillis.
French Eq.—Corps étrangers dans les amygdales.
German Eq.—Fremdkörper in den Tonsillen.
Italian Eq.—Corpi stranieri nelle tonsille.

Definition.—Concretions and calculi imbedded in the substance of the tonsils—the result of a perverted condition of the natural secretions and of closure of the outlets of the lacunæ of the glands.

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[1] Gazzetta Med. Ital. Prov. Sard., December 30, 1861.
[2] Dict. des Sciences Médicales, Paris, 1866, vol. iv. p. 31.
[3] Foreign substances, which are arrested and detained by the tonsils, during their passage through the pharynx, are considered in the article on Foreign Bodies in the Pharynx.

Etiology.—When the tonsils are in a state of chronic inflammation, the secretions of the follicles are frequently altered in character and augmented in amount. As a consequence, the lacunæ may become blocked up by the secretion, which sometimes becomes so inspissated as to attain the hardness of a calculus.[1] In some instances calculi have been met with as large as a cherry, or even larger.[2] The presence of calculi in the tonsils has been thought by some practitioners to proceed from a gouty affection of the throat, but this supposition is entirely disproved by the analysis of tonsillar calculi, which, instead of being composed of urates, consist principally of phosphate and carbonate of lime.[3]

Symptoms.—The symptoms of this disease are not, as a rule, very prominent. A slight pricking sensation in the throat is generally complained of, and when the concretions are large and numerous, there may be dysphagia. Occasionally small calculi are discharged spontaneously from the tonsil, causing slight soreness and bleeding. In most cases the concretions predispose to attacks of quinsy, whilst they not unfrequently cause ulceration of the walls of the cavity in which they are contained, and sometimes lead to the formation of abscesses in the substance of the tonsil. In three instances I have seen prolonged suppuration determined by the presence of a calculus, and the purulent discharge only ceased on the extraction of the offending substance.

Pathology.—Several writers have made an analysis of tonsillar accretions, with a tolerably uniform result as to the composition of these morbid formations. They vary slightly as to the proportions of their chemical elements according to the amount of hardness to which they attain. Thus they contain phosphate and carbonate of lime, a little iron, soda, and potassa, and when soft a considerable amount of water and mucus.[4] When the lacunæ are filled by a gray, semi-fluid, or mortar-like matter, microscopic examination reveals the presence of epithelium, cholesterine, pus-corpuscles, bacteria, mould-fungi, and molecular masses or globules of chalk.[5]

Diagnosis—The presence of concretions or calculi in the tonsils can only be recognized with certainty when portions of the foreign substances are either discharged spontaneously, or can be seen projecting from the lacunæ of the glands, or can be felt with the finger or pharyngeal sound.

Treatment.—The only satisfactory procedure consists in the removal with forceps of the concretions or calculi; or, should there be any considerable hypertrophy of the tonsils, the diseased glands must also be extirpated. In such cases the bistoury is sometimes preferable to the tonsillotome, as the blade of the latter instrument cannot always sweep round, or cut through the substance of, a large calculus.

Parasites in the Tonsils.

As an appendix to this article it may be mentioned that some scattered instances are on record in which certain parasites, such as hydatids

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[1] Louis: Mém. de l'Acad. de Chir., t. v. p. 463 et seq.
[2] Wagner: Ziemssen's Cyclopædia, vol. vi. p. 970.
[3] Desnos: Dict. de Méd. et de Chir. Prat., vol. ii. p. 117, Paris, 1865.
[4] Tangier: Anal. d'un Calcul Tonsillaire, Journ. de Chimie Méd., 1826. Also Wurzer: Buchner's Rep. f. d. Pharm., xxiii. 2 H.
[5] Wagner: Ziemssen's Cyclopædia, vol. vi. p. 970.

and trichocephali, have been met with in the tonsils. Dupuytren[1] relates the case of a young woman aged twenty-one, who for eleven months had suffered from attacks of inflammation of the tonsils. The left gland was considerably swollen, and the surgeon having diagnosed an abscess, plunged a bistoury into the tumor. As a result, nearly two ounces of watery fluid gushed out, and ultimately a large hydatid cyst, the size of a fowl's egg, was extracted. At the time the patient was affected with an abdominal tumor, and as she died soon after from an attack of erysipelas, an autopsy was made. An ovoid cyst was discovered, similar to that contained in the tonsil, but as large as a child's head, attached to the left kidney. An almost similar case, except that the patient was a man, is reported by Davaine,[2] and the same observer relates an instance in which a trichocephalus was found lodged in the left tonsil. The parasite had probably attained this situation through being expelled from the stomach during the act of vomiting.

DILATATION OF THE PHARYNX.

(Synonyms: Pharyngocele. Pharyngeal Pouch.)

Latin Eq.—Dilatatio pharyngis.
French Eq.—Dilatation du pharynx.
German Eq.—Erweiterung des Schlundkopfs.
Italian Eq.—Dilatazione della faringe.

Definition.—Enlargement of the cavity of the pharynx, either in its entire circumference, or at a particular part, so that a pouch or diverticulum is formed.

Etiology.—From the nature of its surrounding and supporting structures, the pharynx rarely undergoes any considerable concentric dilatation, except at its lower part, or when the morbid condition also affects the œsophagus.[3] Occasionally, in cases of cicatricial contraction or of stricture of the gullet, the œsophagus undergoes considerable dilatation, and the lower part of the pharynx may participate in this expansion. Dilatation of the pharynx, however, is more frequently confined to a limited portion of its circumference, and the stretched membrane, by projecting in one or other direction, constitutes a pouch or diverticulum. Such a protrusion really deserves the name of a *hernia*, as it consists of the mucous and sub-mucous coats only, which pass out between the fibres of the muscular tunic of the pharynx. Diverticula of this nature generally extend backward and downward, and make their way between the œsophagus and vertebral column, whilst occasionally they project laterally and form a tumor at the side of the neck. Rokitansky[4] conceives that diverticula sometimes result from small foreign bodies, such as cherry stones, having become lodged at some part of the pharynx. The etiology

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[1] Leçons Orales, t. ii. p. 179.
[2] Traité des Entozoaires, etc., Paris, 1860.
[3] See a case figured in the article on Dilatation of the Œsophagus.
[4] Pathological Anatomy (Syd. Soc. Trans.), vol. ii. p. 12.

of their formation is not clear, but it seems most probable that they arise from a weakness at some part of the pharyngeal walls, which causes the membrane to yield when any unusual strain is applied. I have met with three cases in persons who had resided for many years in tropical climates, and in whom there were other symptoms of relaxation. A habit of "bolting" food is likely to disturb and vitiate the functions of the involuntary muscles of the pharynx and œsophagus, by thrusting more substance into the channel than can be carried down without stoppage; and I have ascertained that there was carelessness and hurry in eating in several of the cases of pharyngeal dilatation that have come under my notice. Finally, diverticula of the pharynx have occasionally been met with as congenital malformations, and in such cases it is possible that they may be relics of the branchial clefts.[1]

Symptoms.—The prominent symptom of a pharyngeal diverticulum is dysphagia, *i. e.*, difficulty, unaccompanied with pain, in swallowing. Portions of food become arrested from time to time in the pouch, which thus forms a temporary solid tumor in the neck. In this way, when the diverticulum is situated between the vertebræ and the gullet, the obstruction may be so great as to close the passage. In many cases the phenomena simulate those of stricture of the œsophagus. The diverticulum, however, becomes emptied after awhile, and the occurrence is followed by a great temporary relief to the patient. Thus the symptoms vary considerably at different periods. The mechanism by which the contents of the pouch are voided is not well understood. The accumulation of food is ejected so that the patient thinks he is vomiting, but the process is unaccompanied by retching or nausea. In some cases the receptacle discharges its contents so gradually that a kind of rumination seems to be established. In other instances fragments of food find their way into the larynx whilst passing from the diverticulum, and give rise to severe attacks of spasm or to fits of coughing.[2] Such foreign matter may even find its way into the lower parts of the air-passages, and give rise to bronchitis or pneumonia. Sometimes it happens that the diverticulum becomes inflamed, and a cure results from adhesion of the opposite walls of the sac. Such inflammation may, however, lead to sloughing and extravasation of food into the postpharyngeal connective tissue. Cases of pharyngeal pouch may continue for years without causing any dangerous symptoms. I have seen several examples where the disease had been going on for twenty or thirty years, and was lately consulted by a patient in whom the symptoms had existed for fifty-one years. In none of these cases was the nutrition seriously affected. In most of them the patients had lived for a considerable period on liquid food, and the oldest of my patients had supported himself on spoon-diet for twenty-seven years.

Pathology.—The opportunity for a post-mortem examination rarely arises, but in a case reported by Rokitansky,[3] where the symptoms had existed forty-six years, the mucous membrane of the back of the mouth was thickened, whilst that of the upper part of the larynx was œdematous. On a level with the inferior constrictor of the pharynx the mucous membrane was prolonged through the fibres of the muscle into a diverticulum

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[1] See a case by Mayr in the Jahrbuch z. Kinderheilkunde, iv. 3, p. 209, 1861.

[2] See a preparation in the St. George's Hosp. Museum, Series ix. No. 14. The patient, æt. 63, died from pneumonia. He had previously suffered from repeated attacks of inflammation of the larynx.

[3] Archives Générales de Méd., 1840, t. ix. p. 329.

about two inches in length. This pouch was enveloped with the cellular tunic of the œsophagus in such a way that the pharyngeal canal opened directly into this cavity instead of into the gullet. On trying to pass the finger or a sound into the œsophagus it was impossible to avoid diverging into the diverticulum. The walls of the pouch contained a few bands of pale, muscular fibres, whilst near its aperture the œsophagus was greatly narrowed, and the remaining extent of this canal was atrophied.

Diagnosis.—An uniform dilatation of the pharynx can readily be ascertained by digital and laryngoscopic examination. A pharyngocele may generally be diagnosed from the history of the case. The difficulty of swallowing, the sensation of a foreign body in the throat—augmented after meals, the presence of a soft tumor on the outside of the neck, which can be dissipated by pressure, and the frequent ejection of small portions of undigested food, are all phenomena almost pathognomonic of the condition. By the use of a sound the form, size, and direction of the diverticulum can usually be determined.

Prognosis.—Enough has already been said to show that this affection is more frequently productive of inconvenience than of any immediate danger, although in some cases life is no doubt shortened by the condition. The chances of cure are extremely small, and little result can be expected from remedial measures, except when the pouch is at the side of the pharynx.

Treatment.—Where there is slight general dilatation, independent of stricture of the œsophagus, increase in the contractile power of the constrictors may occasionally be obtained by the frequent application of faradism and galvanism. In the case of a diverticulum such treatment is unavailing, but if the pouch be situated laterally, so that pressure can be brought to bear on it from the outside of the neck, the patient is enabled to empty it himself,[1] and thus avoid any serious symptoms. In such cases swallowing may be greatly facilitated by pressure with the finger on the neck opposite the diverticulum whilst eating. Under these circumstances the morbid condition may be present for an almost unlimited period without causing any ill effects beyond an inconvenience during meals. In several instances I have been able to give great relief to patients by directing them to wear a stiff stock with a pad over the seat of the diverticulum. When, however, there is danger from repeated suffocative attacks, or from inanition, it will be necessary to try and avert the peril. Should the aperture of the pouch be small, and be visible either by the unaided eye or by the laryngoscope, an attempt may be made to produce cicatricial contraction of the opening by the local application of galvanic cautery. If these measures fail, an operation similar to œsophagotomy might be undertaken, and the pouch excised. This having been done, the edges of the mucous membrane would have to be carefully brought together and secured by stitches. After such a precedure, in order to avoid traction on the wound, it would be necessary to feed the patient through a tube until union had taken place.

[1] See No. 1886 in the Royal College of Surgeons' Museum, removed from the body of a man æt. 90.

CANCER OF THE PHARYNX.[1]

Latin Eq.—Carcinoma pharyngis.
French Eq.—Cancer du pharynx.
German Eq.—Krebs des Schlundes.
Italian Eq.—Cancro della faringe.

Definition.—Primary malignant disease of the pharynx, generally causing death by starvation, but sometimes by hemorrhage.

Etiology.—Primary malignant disease of the pharynx may originate in the walls of that cavity, or in the tonsils. It is rare in the pharyngo-oral space, but very common in the lower portion of the canal, where it generally first attacks the posterior wall, and, passing round the sides, subsequently invades the larynx. The latter cases are not usually classified as pharyngeal affections, but are included in cancer of the œsophagus; and the remarks commonly made as to the rarity of pharyngeal cancer are based on the observation of the disease by unaided vision. The same obscurity which surrounds the etiology of cancer in other parts holds good as regards the pharynx, and heredity is the only known influence about which there is no uncertainty.

Out of 8,289 deaths from cancer recorded in the Paris registers 3 were ascribed to cancer of the tonsils and 4 to cancer of the pharynx ;[2] but these statistics could only have had reference to cancer in the pharyngo-oral cavity.

Symptoms.—When the disease is in the pharyngo-oral space the tumor can always be seen, and can also be felt with the finger. The voice becomes thick, articulation indistinct, and the expectoration fetid. The affection causes constant pain, which is greatly increased on attempted deglutition. The pain becomes greater when ulceration commences, and often darts into the ear. As the disease advances the respiration becomes obstructed, and great inconvenience is often experienced from the posterior nares being blocked up. When the cancer is situated in the pharyngo-laryngeal cavity, the symptoms, course, and termination of the affection are almost identical with the phenomena attendant on malignant disease of the œsophagus, and the disease generally runs a slower course than when it occurs in the pharyngo-oral space. In the lower situation there is dysphagia, but often no odynphagia. As a consequence, the patient takes more food, and lives longer, and more time is allowed for the development of the characteristic cancerous cachexia. The constant expectoration of a frothy mucus is a characteristic symptom. The disease sometimes leads to perforation of a vessel, from which fatal hemorrhage may ensue.

Pathology.—When the disease is situated in the *pharyngo-oral* cavity, it is usually of the scirrhus variety, presenting, as Delpech[3] remarks,

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[1] In this article, the disease is considered in so far as it relates to the pharyngo-oral and pharyngo-laryngeal cavities. Cancer of the *pharyngo-nasal* cavity will be considered in connection with diseases of the nose.

[2] Walshe : The Nature and Treatment of Cancer, 1846, pp. 265, 267.

[3] Dict. des Sc. Méd., Paris, 1812, vol. iii. p. 611.

a considerable resemblance to malignant disease of the rectum. Physically the first sign of scirrhus of the upper part of the pharynx is a hard, imperfectly circumscribed mass, occupying a variable extent of the submucous tissue of the tube, and invested by the mucous membrane, which in the early stages retains to all appearance its normal character. At this period a hard elevation can usually be felt, whilst pressure does not, as a rule, occasion any pain. As the malady progresses the induration gradually extends over the greater part of the pharynx, and may involve the veil of the palate and the orifices of the posterior nares. Ulceration next commences, and extends over the whole of the affected part, presenting a reddish or greenish white surface covered with fetid exudations, and, later, numerous fungous elevations arise from the surface of the ulcer. Tumefaction of the cervical glands about the angle of the jaw generally takes place at an early period. I have seen many cases of cancer in which the upper part of the pharynx and the epiglottis were both affected, in which it was impossible to determine in which part the disease originated. A case of this sort was exhibited by me at the Pathological Society some years ago,[1] and a typical example has been described and figured by Mr. A. T. Norton.[2]

Cancer of the *pharyngo-laryngeal cavity* is a very common disease. It is usually of an epitheliomatous character, though scirrhus occasionally occurs. It commonly commences just below the level of the arytenoid cartilages. In the earlier stages, pale grayish white slough-like vegetations can be seen with the laryngoscope at the lower part of the pharynx, surrounded by a zone of bright red, swollen, mucous membrane. Sometimes the disease commences in the thyroid fossa, but in nearly all cases, whether originating at the back or the sides of the pharynx, it extends round the cavity and reaches the air-passage. As the disease progresses, considerable tumefaction of all the tissues takes place, but the cervical glands are not generally enlarged.

Diagnosis.—The diagnosis of cancer of the pharynx seldom presents any difficulty, although cases are on record in which syphilitic condylomata [3] and gummata [4] were mistaken for malignant disease. The use of iodide of mercury and iodide of potassium respectively cured the cases referred to, and demonstrated the error of diagnosis. A fibroma may also be mistaken for encysted cancer, but its peduncle generally serves to distinguish it, and it shows no disposition to ulceration.

Prognosis.—The disease must necessarily end in death, and the only doubt which can exist in the prognosis relates to the question as to how soon the malady may be expected to prove fatal. The duration of life is generally much shorter when both respiration and deglutition are affected than when swallowing alone is impaired.

Treatment.—Palliative measures alone can be adopted. Should respiration be dangerously incommoded, tracheotomy will often obtain a prolongation of life, whilst inability to swallow must be met by the use of the œsophageal tube, or by the administration of nutritive enemata.[5] Finally, an attempt may be made to prolong life, by resorting to œsophagotomy, hereafter described. Scirrhus, in the lower part of the pharynx,

[1] Trans. Path. Soc., vol. xix. p. 71.

[2] Ibid. vol. xvi. p. 53.

[3] Fournier: Plaques muqueuses hypertroph. des Amygdales; M. Fano: Thèse d'Agrégation, 1857.

[4] Lancereaux: Treatise on Syphilis (New Syd. Soc.), 1868, vol. i. p. 310.

[5] See the article on Cancer of the Œsophagus, in this work.

is the form of cancer most likely to furnish a suitable case for such an operation.

Cancer of the Tonsils.

This is a rare disease, but cases have been reported by Velpeau,[1] Maisonneuve,[2] Lobstein,[3] Lennox Browne,[4] etc. Most of the reported instances belonged to the encephaloid variety, the disease being in some cases primary and in others due to extension from adjacent parts. I have met with seven cases of cancer of the tonsils, five of which were encephaloid, and two scirrhous. The following short summary shows the sex and ages of the patients:—

Encephaloid.			Scirrhous.	
Males.		Female.	Male.	Female.
Æt. 22 " 37 " 58 " 67	4	Æt. 43 . . . 1	Æt. 47 . . . 1	Æt. 34 . . . 1

The average duration of life after the symptoms appeared was seventeen months, the maximum having been twenty-five, and the minimum nine months. One or both tonsils may be the seat of the malady, which commences in the form of a tumor situate in the substance of the gland, and at a more advanced period presents an ulcer which there is little difficulty in recognizing as cancerous.[5] Chronic induration and hypertrophy of the tonsils may sometimes simulate malignant disease in the early stages, but the history and progress of the case, together with the age of the patient, afford a definite clue to the nature of the malady. Hypertrophy of the tonsils generally commences early in life, and is rarely met with after the fortieth year. Cancer, on the other hand, is seldom met with before the adult period, whilst all the symptoms become aggravated with comparative rapidity, and a fatal termination quickly ensues. When the cancer is confined to a portion of one or both tonsils, these organs may be excised, with the occasional result of affording the patient a few months' respite.

Cases which clinically are considered cancer, on *post-mortem* examination are often found microscopically to be of the *lymphomatous* or *lymphosarcomatous* character. A remarkable instance of this kind has been reported by Dr. Moxon,[6] in which the left tonsil, the lymphatic glands, and the spleen were all the subjects of a brain-like growth. These tumors consisted for the most part of cells, kept together by a network of fine fibres. The cells were larger than lymph-cells, and the interior of each was filled with a large nucleus and many nucleoli. I have met with a somewhat similar instance in a patient aged fifty-seven, in whom both tonsils and the lymphatic glands of both sides were affected with similar cellular growths. In this case the development of the tumor was checked for a

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[1] Liégeois : Dict. des Sc. Méd., Paris, 1864, vol. iv. p. 26.
[2] Bulletin de la Société de Chirurg. : Cancer des Amygdales, 1859.
[3] Anatomie Pathologique, 1829, vol. i. p. 429.
[4] The Throat and its Diseases, London, 1878.
[5] Lébert : Traité des Mal. Cancér., 1851, p. 422.
[6] Trans. Path. Soc., vol. xx. p. 369.

long time by subcutaneous injections of acetic acid. I have also seen two cases of simple lymphoma of one tonsil, in patients aged respectively twenty-seven and thirty-two. In each case life was prolonged by repeated removals of diseased structure, but the affection ultimately proved fatal from dysphagia and consequent marasmus. In my three cases of lymphomatous disease of the tonsils the patients were men.

NON-MALIGNANT TUMORS OF THE PHARYNX.

Latin Eq.—Tumores non maligni pharyngis.
French Eq.—Tumeurs non malignes du pharynx. Tumeurs bénignes du pharynx.
German Eq.—Gutartige Geschwülste des Schlundes.
Italian Eq.—Tumori non maligni della faringe.

Various formations of a non-malignant nature are occasionally met with in the pharynx. I have treated many cases of papilloma, varying in size from a pea to a small grape, situated on the pillars of the fauces, tonsils, or posterior wall of the pharynx. Luschka,[1] Sommerbrodt,[2] and others have also reported cases of pharyngeal papilloma. Large growths of fibrous structure and fatty tumors have also been met with in this region. Barnard Holt [3] has recorded a case in which a fatty tumor springing from the left side of the epiglottis and pharynx hung down into the œsophagus for nine inches. The patient was eighty years of age, and was nearly suffocated on one occasion by the mass being propelled upward, and occluding the larynx during the act of vomiting. The growth was not removed during life, and the man subsequently died suddenly while smoking. Two preparations of pedunculated tumors removed from the pharynx during life are contained in the Royal College of Surgeons' Museum.[4] The first of these is a lobulated mass, about two inches long and half an inch in diameter, and resembles a mucus polypus of the nose. It was attached by a very slender pedicle, not thicker than ordinary twine, just behind the tonsil. In the other case the diameter of the growth is considerably greater. The tumor is of irregular spherical shape, and appears to be of a fibroid nature. Its surface is covered by mucous membrane, but is ulcerated at several points. The mode of attachment is not quite clear, but the tumor seems to have been attached by a stout, strong pedicle to the wall of the pharynx. Voltolini [5] reports the case of a small fibroid growth, about half the size of a pigeon's egg, springing from the posterior wall of the pharynx, whilst Fischer [6] describes a tumor, apparently sarcomatous, which extended from the base of the skull to the cricoid cartilage. According to Busch [7] such tumors may take their origin from the mucous membrane, from the connective tissue posterior to it, from lymphatic glands, or from the periosteum covering the vertebral column. Finally, it may be remarked that growths originating in the

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[1] Virchow's Archiv, vol. l. p. 161. [2] Ibid. vol. li. p. 136.
[3] Trans. Path. Soc., vol. v. p. 123. [4] Nos. 1090 and 1091.
[5] Galvanokaustik, p. 226. [6] Wiener Mediz. Wochenschrift, 1865, No. 61.
[7] Berliner Charité-Annalen, 1857, vol. viii. p. 1.

naso-pharyngeal cavity or posterior nares often descend into the pharynx proper.

Symptoms, etc.—The main symptoms produced by pharyngeal growths are those due to interference by the morbid mass with deglutition or respiration, and they vary with the size and position of the tumor. Small excrescences on the fauces or tonsils cause little inconvenience beyond an occasional sensation of a lump in the throat in swallowing. In some cases the tumor may give rise to troublesome cough, if lying in contact with the larynx or epiglottis. The diagnosis of growths in the pharynx can generally be made without difficulty on examination with the unaided eye or by the aid of the laryngeal mirror.

Treatment.—Small growths, such as papillomata, may be torn off by strong forceps, or can be quickly destroyed by the application of London paste (Throat Hosp. Phar.). Larger formations, if pedunculated, may be removed by forceps, by galvanic cautery, or by the écraseur, or the base may be encircled by a ligature, and the tumor then be cut off with the knife. In the case of growths of such a size as to fill up a great part of the pharynx, care must be exercised in their removal. Thus we see that in Holt's case the mere displacement of the tumor upward was sufficient to produce suffocation by occluding the larynx. Should the attachment of the growth be extensive and vascular, excision is attended with the risk of asphyxia from hemorrhage. Under these circumstances it has been recommended first to perform tracheotomy, and as soon as the patient is able to breathe freely through the tube to remove the morbid mass in the pharynx.[1]

SYPHILIS OF THE PHARYNX.

Latin Eq.—Syphilis pharyngis.
French Eq.—Angine syphilitique.
German Eq.—Syphilis des Schlundkopfs.
Italian Eq.—Angina sifilitica.

Definition.—Syphilis attacking the pharynx and presenting the phenomena met with in the three stages of that disease when affecting mucous surfaces.

Etiology.—Syphilis of the pharynx may be the result of direct inoculation with the specific virus of the disease, but is generally a local manifestation of the malady after it has become constitutional; occasionally it is hereditary. The primary chancre, when situated in the pharynx, is almost always found on one of the tonsils, owing, no doubt, as Desnos[2] remarks, to the structure of these glands, the lacunæ of which are likely to receive and retain the syphilitic virus when introduced into the throat.[3]

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[1] Durham: Holmes' System of Surgery, vol. iv. p. 489.

[2] Dict. de Méd. et de Chirurg. Prat., vol. ii. p. 149.

[3] The revolting practices which lead to these affections have been alluded to by Diday and Desnos, to whose writings those interested in the question are referred for further information.

Diday[1] explains that the disease should theoretically be more common among females, and my own experience tends to confirm his hypothesis. Thus, out of seven cases of primary syphilitic sores which I have met with on the tonsils, six of the patients were women. In Diday's own cases, however, the affection was divided equally between the two sexes; whilst Desnos,[2] from the examination of a mass of statistics, concludes that the primary sore is not more frequent amongst females, and explains the mode in which the disease is established in this situation in males. The rarity of chancre of the pharynx may be estimated from the fact that of 673 examples of chancres in all situations, not one was found behind the anterior pillars of the fauces; whilst of seventy-seven primary sores of the buccal region only one had its seat on the tonsil.[3] Secondary and tertiary syphilitic phenomena in the pharynx are among the commonest local manifestations of the disease, when it has become constitutional, as the result of inoculation or heredity. As Swediaur[4] observed long ago: "When the syphilitic virus is absorbed into the mass of the blood, in the majority of cases it produces its first effects on the throat." According to Martellière,[5] the causes which commonly give rise to the ordinary acute and chronic diseases of the pharynx determine the specific disease to attack that part in syphilitic persons. With respect to the frequency with which the throat becomes the seat of lesion in constitutional syphilis, the same authority states that, on examining seventy-two patients affected with the malady, he found only twenty-one in whom the pharnyx did not present some characteristic alteration.[6]

Symptoms.—The symptoms of syphilis of the pharynx vary, subjectively and objectively, according to the phase of the disease under which they appear. In primary syphilis but one local lesion can occur, viz., the product of direct inoculation—the chancre. In the secondary stage, the disease may present itself under the form of erythema or mucous tubercles (condylomata). At the third period, likewise, we may find two distinct sets of phenomena in different cases, viz., ulceration and gummata. The sequel of ulceration is often contraction of the tissues of the pharynx, and narrowing of its canal and the passages leading from it.

1. Although the primary syphilitic sore is rare, Diday[7] states that he has met with eight cases, and believes that the chancre, when occurring in this situation, is generally overlooked both by patient and practitioner. I have myself seen seven cases in which no reasonable doubt could be entertained as to the nature of the disease; but in two of these the diagnosis would have been very difficult from the physical condition alone. The local appearance is generally that of an ulcer superficial, but surrounded by an elevation of slightly œdematous mucous membrane. By the touch it can be ascertained to have an indurated base, and in most cases there is very manifest swelling of the glands about the angle of the jaw. The characters of the hard chancre are not, however, always so well marked. Thus, in a patient of Diday's[8] a mere superficial erosion of the left tonsil, with slight glandular engorgement, was soon followed by the phenomena of secondary syphilis. In two other examples given by the same writer[9] a phagedænic form was assumed by the chancres,

[1] Compt. Rendus de la Soc. de Méd. de Lyon. 1861–62, t. i. p. 45.
[2] Loc. cit. [3] Ibid.
[4] Pharyngitis Syphilitica, 1801, t. ii. p. 147.
[5] De l'Angine Syphilitique, Thèse de Paris, 1854, No. 6, p. 10.
[6] Ibid. p. 9.
[7] Loc. cit. [8] Ibid. [9] Ibid.

and deep, unhealthy-looking ulcers extended rapidly for several days. It is only in these cases that local or constitutional symptoms, such as pain, stiffness of the jaw, and pyrexia, are likely to attract the notice of the patient. As a rule, the chancre runs its course and heals without making much impression on the health or sensations of the person affected.

2. (*a.*) Erythema of the pharynx is a very common secondary manifestation of syphilis. Thus, out of 114 women affected constitutionally, Pillon[1] noted the affection sixty-five times.

The first symptoms of the affection are those of an ordinary sore throat, viz., dryness of the fauces, slight pain on deglutition, and occasionally a mild pyrexia. On inspecting the throat at an early period, the veil of the palate, the pillars of the fauces, and the tonsils are seen to be uniformly red. In a day or two, however, the erythema shows a decided tendency to limit itself by abrupt and well-defined margins to a certain portion of the pharynx, and to assume a symmetrical arrangement. It may affect the fauces on each side and the back of the pharynx—terminating suddenly at the anterior pillars, or it may cease at the centre of one tonsil, whilst extending over the whole of the opposite side. The redness never fades away gradually into the healthy tissues, but is bounded by a very distinct line of demarcation. According to Pillon,[2] a species of erythema manifests itself in the throat at a later period of secondary syphilis, which is characterized by a grayish tinge, and by granulations on the surface of the mucous membrane.

(*b.*) Mucous patches (syn.: mucous tubercles, broad condylomata, *plaques muqueuses*) are present in the pharynx in a large proportion of cases of secondary syphilis. When occurring as the result of heredity, they are found in the upper part of the pharynx and on the fauces soon after birth. In adults they are generally seen on the pillars of the fauces and the veil of the palate. At first they are very slightly elevated, are of a circular or elliptic form, and nearly always symmetrically situated on each side of the throat. At a later stage they become the seat of shallow ulcerations, their surface changes to a grayish white color, and their edges become uneven. In six or eight weeks they generally disappear spontaneously, their former position being marked by a slightly deeper shade of the mucous membrane. While they last they cause considerable soreness of the throat, especially on deglutition. The skin manifestations associated with condylomata are usually of the nature of syphilitic papulæ, though some of the other early syphilides may be present.

3. (*a.*) The ulcerations of tertiary syphilis may be divided into two varieties, viz., *superficial* and *perforating*.[3] The superficial ulcers most frequently occupy the veil of the palate, but they are sometimes seen on the pillars of the fauces and the tonsils. They extend with great rapidity, but generally attack only the superficial tissues. These ulcers are sometimes of *serpiginous* form, and are generally covered with an ichorous pus; but if this is cleared away the base is seen to be pale and smooth, with here and there some fungous granulations. The edges are irregular and jagged, and cracks or fissures sometimes proceed from them and extend for a considerable extent into the surrounding tissues. When these ulcers occur in scrofulous persons they are often very intractable, and the

[1] Des Exanthèmes Syphilitiques, Thèse de Paris, 1857, p. 19.
[2] Loc. cit. p. 13.
[3] See Lancereaux : Treatise on Syphilis (New Syd. Soc.), 1868, vol. i. p. 305.

affection has been called *scrofulo-syphilitic*, but there does not seem any adequate reason for recognizing this complication as a separate disease. Perforating ulcers probably always originate in the softening of gummata. They may be situated on any part of the palate, tonsils, fauces, or back of the pharynx, and, as Lancereaux[1] says, "they gain in depth what they lose in extent." Commencing by an inflammatory redness, after a few days a spot of a dirty white color appears at the centre of the inflamed patch, and at this point the tissues beneath become liquefied. The destructive action extends deeply, and attacks cartilage, periosteum, and even bone. Thus the palate bone, the basilar process, and the bodies of the vertebræ may become necrosed or carious. In a case[2] under my own care, where there was a deep ulcer on the posterior wall and right side of the pharynx, the patient lost more than a quart of blood, and, as she soon afterward expectorated the transverse process of the second cervical vertebra, the hemorrhage was believed to come from the vertebral artery. Lesions of the brain and spinal cord may also result from the ravages of syphilis on the osseous walls enclosing these nervous centres. If the skin is affected in this stage of the malady, it is generally rupia that occurs. The constitutional symptoms which accompany tertiary syphilis often denote a serious dyscrasia, and loss of appetite, emaciation, and hectic sometimes carry off the patient. Tertiary syphilitic ulceration, destroying the back of the palate, is not unfrequently the result of heredity. The ulceration breaks out fresh from time to time, and the patients, when brought for medical treatment, vary in age from three or four years to fifteen or sixteen. In later years it is not always possible to distinguish between hereditary and acquired disease. When the disease attacks the pharynx in this way, the anterior part of the mouth escapes, and the permanent central incisors are not notched.

(*b.*) Gummy tumors, of various parts of the body are amongst the most characteristic phenomena of the advanced stage of constitutional syphilis. In the pharynx they are generally situated under the mucous membrane of the posterior wall, but are sometimes seen in the soft palate.[3] At first they are small and insensible, and they usually make very slow progress. As they increase the mucous membrane covering them becomes injected, and presents a violet-red color. At the same time, the glands about the angle of the jaw commence to enlarge. After existing for a variable time the gumma arrives at a stage of softening, and perforates the mucous membrane. It may either give rise to inflammatory tumefaction of the superjacent tissues, and cause a common form of tertiary ulceration, leaving no trace of the nature of its origin, or it may perforate the mucous membrane at several spots, and give slow exit to a continuous discharge of ichorous pus. When the gumma is situated in the soft palate the tissues on both sides are eaten through. Thus a fistulous communication is established between the mouth and the posterior part of the nasal cavity. The edges of such fistulæ or ulcers are generally cleanly cut, and cicatrization proceeds very slowly. In these cases there is generally a disagreeable nasal voice, and in swallowing, fluids often pass up into the nose. When gummata are seated at the back of the pharynx, they sometimes originate in the periosteum of the vertebral column, and, after becoming enlarged and softened, perforate the mucous membrane.[4] The termination, however, of gummy tumors is not inevita-

[1] Op. cit. p. 305.
[2] Trans. Path. Soc. vol. xx. p. 283.
[3] See a case by Martellière: Op. cit. p. 58.
[4] Martellière: Op. cit.

bly ulceration, for they are often reabsorbed under the influence of specific treatment.

When the ulcerative process attacks both the posterior wall of the pharynx and the soft palate, the two surfaces may be brought into apposition by the inflammatory tumefaction, and union of the opposing ulcerated surfaces sometimes takes place. Dr. Schech [1] believes that cicatricial contraction of the pharynx is not only the result of deep and extensive ulceration, but that it is frequently due to superficial erosions and denudation of the epithelium. According to that observer, it is not necessary that the ulcers or erosions should occur at the same time on the pharynx and palate, although, as a matter of fact, they are more often simultaneously present. Schech considers that the *perforation of the palate greatly favors the pharyngeal stenosis.* The loss of tissue and the consequent altered muscular relations cause a diminution of the normal tension of the soft palate, so that its mobility is impaired, and it cannot recede from the pharyngeal wall as easily as in health. The base of the uvula thus often remains in contact with the wall of the pharynx for a considerable length of time—especially when the patient is recumbent. Schech further points out that the exit of air through the perforation favors adhesion by lessening and diverting the current of air which, in coughing, sneezing, and hawking, tends to break down the recently-formed adhesions in those cases where there is no opening in the palate.

The isthmus of the fauces loses its normal arch, and the velum, or whatever may remain of it, is drawn backward by white cicatricial tissue radiating from the hard palate to the posterior wall of the pharynx. Sometimes the communication between the nose and the pharyngeal cavity is entirely cut off, whilst only a minute opening leads to the lower part of the pharynx. When the posterior nasal passage is completely occluded, the sensation in the nose is often most distressing. There is a constant feeling of dryness and stuffiness, the patient is unable to clear his throat, and suffers from loss of smell and taste. When the passage to the lower part of the pharynx is contracted, there is difficulty of swallowing and dyspnœa. It not unfrequently happens that the entrance of the larynx or orifice of the œsophagus is greatly contracted, and then the symptoms are even more severe.

Prognosis.—The prognosis is in most cases favorable as regards life in the early syphilitic affections of the pharynx, but serious in relation to the later manifestations. Secondary phenomena often pass away without treatment, and are not dangerous while they last. Should erythema extend to the larynx, it does not give rise to œdema of the glottis, nor to any serious swelling of the lining membrane. The same remark applies to mucous tubercles. The lesions of tertiary syphilis, however, must be attentively considered in each case before arriving at a decided prognosis. Death may result from the destructive ulceration of the coats of a large vessel; and in less serious cases, cicatricial narrowing of the air-passages, or destruction or perforation of the soft palate, may occasion permanent injury to the functions of the degluto-respiratory canals. Extensive ulcerations may lead to caries of the neighboring bones, and induce death by establishing a persistent drain on the constitution. Should the base of the skull or vertebral column become diseased, fatal lesions of the brain or medulla spinalis may, as already remarked, be provoked. The

[1] Deutsches Archiv für Klin. Medicin., 1876, xvii. Nos. 2 and 3.

disease may reach the larynx, and give rise to the dangers hereafter described under "Syphilis of the Larynx."

Diagnosis.—The diagnosis of a primary syphilitic sore situated in the pharynx is beset with uncertainties. Not only is it a difficult and delicate matter to ascertain the history of such cases, but the local appearances are by no means pathognomonic. On this account it is generally impossible to arrive at a decided opinion until the development of constitutional phenomena, and the results of treatment combine to confirm our first suspicions. If a suspicious ulcer remain obstinate to all internal remedies and local applications (such as nitrate of silver and nitrate of mercury, etc.) for four or five weeks, we may feel almost certain as to the specific origin of the disease. If secondary syphilitic symptoms subsequently arise, still less doubt can be entertained respecting the nature of the primary ulceration. The diagnosis of syphilitic erythema of the pharynx depends principally on the simultaneous appearance of the same eruption of the skin, and on its symmetrical disposition. The pale, raised, symmetrically situated tubercles, surrounded by the brightly congested mucous membrane, can scarcely be confounded with any other condition. When these guides are not present, the history of the case, and the presence of the cicatrix of the primitive sore must be ascertained in order to arrive at a definite opinion. Tertiary ulceration is sometimes with difficulty distinguished from cancer; but in the latter disease there is generally more thickening and less destruction of tissue, and the local coloring is much brighter. An ulcerating gumma may resemble cancer for a time, but the progress of the case soon reveals its real nature. In pharyngeal phthisis the ulcers are generally very small, the dysphagia is much greater, and there is generally a very high evening temperature, which is altogether absent in syphilis.

Treatment.—Should a chancre of the tonsil be positively diagnosed, the surgeon will either adopt, or abstain from, mercurial treatment, according to his views with regard to the action of that drug. Emollient gargles give relief, but should the primary sore present a phagedænic character, recourse must be had to cauterization with the acid nitrate of mercury.

Secondary syphilitic affections of the pharynx do not usually require any constitutional remedies. For the last eighteen years I have seldom employed any specific treatment for adults. Under the use of local remedies the symptoms rapidly disappear, and I have rarely met with tertiary phenomena in the throat amongst those whom I previously treated for the earlier manifestations. Hence it is probable that the non-use of mercury does not increase the risk of a further development of the disease. Should the early phenomena of constitutional syphilis, however, prove intractable, mercury may be administered. Under these circumstances, I generally give it in the form of cyanide of mercury.[1] When the early phases of syphilis are seen in newly-born children, mercury, however, acts most beneficially—especially in the form of gray powder. The resolution of erythema may be hastened by painting the part with a solution of chloride of zinc (20 grs. ad ℥ j.), and mucous patches are best treated by local applications of tincture of iodine.

In the tertiary stage of syphilis our chief resource is the internal administration of iodide of potassium. Under the specific influence of this

[1] Form. R. Hydrarg. Cyanid. gr. $\frac{1}{10}$; Lactis Sacch. gr. $\frac{3}{4}$. Mucilag. Acaciæ q.s. M. Ft. pil. One pill twice daily. (Throat Hosp. Phar.)

drug foul ulcerations become clean and healthy, whilst local tumefactions and gummata are resolved and reabsorbed. It is best to begin with five grains three times a day. The effect should be watched, and the dose may soon be increased with advantage to ten grains three times in the twenty-four hours. Thirty grains a day is generally sufficient, but in some cases as much as ninety grains may be given daily with advantage. In most cases it is advisable to continue the iodide of potassium for some time after all local phenomena have disappeared, whilst on the slightest sign of any new manifestation the drug should at once be resumed. In those cases where iodide of potassium appears to produce only a temporary effect, and where recurrences are frequent, recourse may be had to the administration of small doses of cyanide of mercury. I have, however, seldom found mercury successful where iodide of potassium has failed. Locally, the treatment of tertiary syphilitic lesions of the pharynx varies according to the phenomena present. Ulcerations, if indolent, are best treated with a solution of sulphate of copper (15 grs. ad ℥ j.); whilst, if spreading, the progress of the sore can generally be checked with the solid nitrate of silver or acid nitrate of mercury. When there is contraction of the passages leading from the pharynx, the canals must be dilated with bougies, forced open with dilators, or enlarged by the destructive action of galvanic cautery. Dr. Rothenburg[1] has also recommended excision of a portion of the cicatricial tissue. The use of bougies is, perhaps, on the whole the most satisfactory method of treatment, as forcible extension or destruction of tissue is generally soon followed by fresh cicatrization. In any case, however, though great relief can be afforded to the patient as long as he remains under treatment, no cure can be predicted, as the stenosis always returns when mechanical measures are suspended.

PHTHISIS OF THE PHARYNX.

Latin Eq.—Phthisis pharyngea.
French Eq.—Tuberculose miliaire de la gorge.
German Eq.—Miliartuberculose des Pharynx.
Italian Eq.—Tubercolosi miliare della faringe.

Definition.—Ulcerations and deposits of miliary tubercle arising in the pharynx either as primary local manifestations of constitutional phthisis, or secondary to similar phenomena occurring in the lungs, larynx, or other organs of the body.

History.—Within the last fifteen years there has been a growing tendency to recognize certain conditions of the pharynx accompanied by ulceration as intimately connected with the tubercular diathesis, and to differentiate the obscure phenomena sometimes met with in other affections, especially syphilis. The subject of pharyngeal phthisis had been touched on by Green,[2] Bryk,[3] Rindfleisch,[4] Wendt,[5] and Long Fox,[6] etc.; but the

[1] Wien. Medizin Presse, 1876, No. 33.
[2] Practical Treatise on Pulmonary Tuberculosis, New York, 1864.
[3] Wien. Med. Wochensch., 1864, xiv. Nos. 42, 44.
[4] Lehrbuch d. path. Gewebelehre, Leipzig, 1869, p. 310.
[5] Archiv. d. Heilkunde. xi. p. 566.
[6] Clinical Observations on Acute Tubercle, St. George's Hosp. Reports, 1869, vol. iv.

symptoms and pathology of the disease were first accurately described by Isambert,[1] and subsequently so thoroughly elucidated by Fränkel,[2] that but little remains to be added to our clinical knowledge of the malady.

Etiology.—The etiology of tubercular disease of the pharynx is the same as that of phthisis pulmonalis, viz., heredity or depression of the vital powers resulting most frequently from breathing impure air, or from insufficient nutriment, or residence in a cold, damp climate. The data furnished by the cases observed up to this time do not, however, satisfactorily explain why the pharynx should, in certain instances, become the site of tuberculosis. Almost all of the patients were simultaneously affected with pulmonary phthisis, but by their own statements their attention had first been arrested by a progressively increasing soreness of the throat. In one case, however, reported by Isambert,[3] the subject being a female child, æt. 4½, no pulmonary symptoms could be detected, although the condition of the pharynx was typical of tubercular disease. Fränkel, as a result of his own observations, remarks that the patients seen by him "had not previously suffered from chronic affections of the pharynx, and no ground can be found for assuming that, in them, the pharynx was a *locus minoris resistentiæ*. There was no hyperplasia of the tonsils, nor any condition of the pharynx or fauces, which would entitle me to assume that a cheesy deposit was present here." He, therefore, proposes to leave the question of etiology open for the present.

Symptoms.—Patients suffering from pharyngeal phthisis exhibit the same succession of symptoms as those which are characteristic of ordinary consumption—the throat affection being probably only an accidental complication. The lungs, if not at first diseased, soon become affected; cough, expectoration, anorexia, hectic, and progressive debility supervene, and, finally, death ensues from exhaustion. Subjectively, the most prominent symptom of pharyngeal phthisis is the pain in the throat. The odynphagia is always great, so much so that Isambert concludes that the pain in deglutition is more severe in this than in any other affection of the part.[4] Thus, the first symptom—prior to cough, expectoration, increasing debility, etc.—which leads the patient to believe that there is anything the matter with him, is often persistent soreness of the throat. This phenomenon once established increases *pari passu* with the development of the local morbid action, and contributes much toward hastening a fatal termination. Severe stabbing pain in the ear during deglutition is also frequently complained of. According to Fränkel,[5] the fever present in tuberculosis of the pharynx shows an unusually irregular course.

It is, in fact, the fever of acute miliary tuberculosis characterized by variable evening temperatures, often up to 104° Fahr., and rising in some instances as high as 107.06° Fahr. In one of Fränkel's cases, the curve of temperature resembled at first that seen in typhus, and afterward that of hectic. In another, the temperature of continued fever (100.4° Fahr. to 101.2° Fahr.) was sustained, when it rose suddenly to 107.06° Fahr., and at the patient's death the thermometer registered 103.1° Fahr.

Objectively, the appearances presented by tubercular lesions of the pharynx are highly characteristic. The ulcers generally begin on the lateral walls of the pharynx, and spread thence to the roof of the mouth,

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[1] Annal. des Mal. de l'Oreille et du Larynx, t. ii. p. 162.

[2] London Med. Record, January 15 and February 15, 1877, and Berl. Kl. Woch., Nov. 1876.

[3] Loc. cit. p. 168. [4] Loc. cit. January 15, p. 2. [5] Loc. cit.

and the posterior wall, as well as to the velum palati. They are of a lenticular shape, and according to O. Weber [1] bear a great resemblance to the corresponding intestinal affection. He describes them as possessing "a caseous, broken-down floor, with undermined hyperæmic edges, in which new tuberculous deposits are imbedded in various stages of development. These rapidly disintegrate, and cause necrosis of the mucous membrane lying between them." In the neighborhood of the ulcers, gray nodules of the size of millet seeds often spring up, and ultimately break down so as to form fresh ulcerations. According to Fränkel, a disposition to hypertrophy coexists with the destruction of tissue; and in the vicinity of the tonsils, especially, polypoid excrescences often arise from the ulcerated base. If the uvula becomes affected it may be enlarged to the thickness of the thumb. Tumefaction, when present, is, as Isambert remarks, not due to an ordinary œdematous condition, but to an infiltration of the tissues by a kind of gelatinous matter, which shows no tendency to escape when scarification is practised. The tendency of the affection, however, is to cause wasting of those parts which do not become the actual seat of the morbid deposit, and, in some cases, the uvula is seen to be atrophied instead of being enlarged. When ulceration attacks the epiglottis, the process of destruction often reduces that organ in a short time to a mere stump. The disease in most cases spreads to the upper part of the larynx, but as a rule does not extend further down than the ventricular bands, and does not give rise to caries of the cartilages. It is worthy of note that the post-mortem examination of the cases of pharyngeal phthisis hitherto met with, has not revealed any tubercular deposit, or ulceration of the œsophagus. In nearly every case of tuberculosis of the pharynx, there is enlargement of the cervical glands which, in many instances, attain the size of a walnut.

The following cases [2] serve to illustrate the disease:—

"Mrs. M. C., a married woman, æt. 29, came under my care on January 14, 1877. Her family history was bad, her mother and only brother having died of consumption. She had always been delicate, but had two healthy children, and there was not a trace of syphilis in the mother, or either of the children. In October, 1876, she first experienced pain in swallowing, and in the November following the glands on both sides of the neck became slightly enlarged. Since October she had suffered very much from feverishness, especially at night, when she always became very thirsty. On examination she was found to be much emaciated, and there was evidence of softening of the apex of the left lung. On examining the throat, small ulcers were seen covering the palate and the right posterior pillar of the fauces, whilst the whole of the back wall of the pharynx was studded with small ulcers, varying in size from a pin's head to a split pea. The uvula was an inch in length; on the right side of the neck one gland was as large as a pigeon's egg, and there were two other indurated glands, each about the size of a filbert nut. The epiglottis was of a pale color, and much thickened, and presented a turban-like appearance. There were superficial ulcers occupying its right half. The ary-epiglottic fold was swollen, and presented a pyriform appearance. The right ventricular band was also thickened and ulcerated. The vocal cords were slightly thickened, and the vocal processes of both cords ulcerated. The

[1] Handb. d. Allgem. u. Spec. Chir. Pitha u. Billroth, Bd. iii. p. 360.
[2] See also Dr. Gee's cases: Barth. Hosp. Reports, vols. vii. and ix.

patient remained under my care for three weeks, and during this time no marked change took place in the appearances described; three small ulcers, however, formed at the back of the tongue, and the anterior pillar (of the fauces) on the right side became ulcerated. The patient was treated with soothing inhalations (vapor benzoini and vapor conii: Throat Hospital Pharmacopœia), but they failed to relieve pain, which was very marked. She subsequently obtained great relief from the insufflation of morphia, but I heard that she died early in March.

"In November, 1876, a young lady, æt. 15, was brought to me on account of great difficulty in swallowing. Her father had been under my care some years previously for laryngeal phthisis, from which he had ultimately died; the rest of the family were healthy. This patient had enjoyed good health until the previous June, when she was accidentally immersed in a river, took cold, and lost her voice. On examination she was found to be very thin and weak; there was marked dulness at the apices of both lungs, but no evidence of softening. The whole of the pharynx was found to be studded with minute ulcerations, which, however, were most marked on its posterior wall. The uvula was greatly thickened, but very little elongated; it had a kind of brawny consistence, and was not at all œdematous. There was a fringe of small excrescences extending along the pillar of the fauces on the right side. The epiglottis was so much thickened that it was impossible to obtain a view of the larynx. In this case the evening temperature at 9.30 was for several nights 104°, and on one occasion 106°. The patient, after remaining under my care for three weeks, and deriving considerable relief from insufflation of morphia twice a day, left England to pass the winter at Cannes, but took cold in Paris, and died in a few days."

Pathology.—At the necropsy of a case reported by Fränkel,[1] ulcers were found on the lateral walls of the pharynx, on the roof of the mouth, on the nasal portion of the posterior wall of the pharynx, and on the velum, while they ceased abruptly at the commencement of the œsophagus. On microscopic examination the base of the ulcer is found to be occupied by a thick infiltration of round cells, which extend deeply into the submucous tissue, even as far as the muscles, which, at these parts, present the transverse striæ less distinctly than usual. The round cells infiltrate the connective tissue of the glandulæ, but do not invade the special gland cells, which are generally in a state of fatty degeneration. The latter have a great tendency to become cheesy, and portions of cheesy matter often lie among the round cells. Isolated gray nodules are rare. In Fränkel's case, above referred to, both lungs exhibited cheesy bronchopneumonia, and an abundance of gray nodules; in the left lung there was a cavity as large as a hen's egg. There were also tubercles in the pleura, liver, and spleen, and tuberculous ulcers in the intestines. In other cases miliary tubercle was found in the choroid membrane and in the kidneys, prostate, thyroid body, etc.

Diagnosis.—Tuberculosis of the pharynx appears to have been generally confounded with syphilis, and to this fact the comparatively scanty amount of clinical observations is probably due. I can recall many cases which, in former years, I put down as tuberculo-syphilitic disease, but which I have no doubt now were instances of pharyngeal phthisis. Now that the disease has been so carefully described, it will be seen that there

[1] Loc. cit. p. 1.

are many points of difference between the two maladies; and the observant practitioner, when once warned, will not be likely to make an error in diagnosis. The lenticular ulcers of pharyngeal phthisis, with the development of gray nodules in their neighborhood, are extremely characteristic, and when once seen can always afterward be readily recognized. The history of the individual cases will usually afford considerable aid to diagnosis, but it must not be forgotten that syphilis and tuberculosis may, in some instances, coexist. Should tubercle of the choroid be present, as occurred in one of Fränkel's cases, we are justified in assuming that there is general miliary tuberculosis. The fact that, in most cases, the pharyngeal symptoms first attract the patient's attention, is of positive value in arriving at a diagnosis.

Prognosis.—Tuberculosis, when manifesting itself in the pharynx, runs a more rapid course than ordinary pulmonary phthisis. Thus, in all the recorded cases, death occurred in a period varying from two to six months. In none of the cases has recovery taken place, and it is probable that the pharyngeal lesions indicate such an extensive implication of all the structures of the body with tuberculosis, that the issue must necessarily be fatal. It is, however, unquestionable, that death ensues more rapidly in some cases than in others ; and, for this reason, Cornil[1] and Isambert[2] have come to the conclusion that there are two varieties of pharyngeal tuberculosis, viz., an acute, and a chronic, form. As the disease almost always terminates fatally in six months, this distinction is scarcely well founded. A certain modification in our prognosis as to the duration of disease may, however, be required in different cases.

Treatment.—As Fränkel[3] observes, the recognition of tuberculosis of the pharynx is more creditable to our diagnostic acumen than to our therapeutic skill. But small results can be hoped for from either local or constitutional measures in such cases. The administration of cod-liver oil with a general tonic and analeptic treatment may be attended with some slight benefit, and the life of the patient may be prolonged for a short time. Almost all writers agree in discountenancing the application of astringent or caustic solutions to the ulcerated surfaces. Isambert states that he has found some advantage from the local use of glycerole of morphia. When the pain is great, sedative remedies may indeed be employed as palliatives, especially in order to lessen the difficulty of swallowing. With this view insufflations of acetate of morphia, gr. $\frac{1}{4}$ to gr. $\frac{1}{2}$ once or twice daily, mixed with powdered starch, and hot soothing inhalations, can often be used with decided benefit; whilst in the worst cases recourse must also be had to nutritive enemata.

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[1] Journal des Connaissances Médicales, July, 1875, p. 193.
[2] Loc. cit. p. 164.
[3] Loc. cit. p. 48.

TRAUMATIC PHARYNGITIS.

Latin Eq.—Pharyngitis traumatica.
French Eq.—Pharyngite traumatique.
German Eq.—Traumatische Schlundentzündung.
Italian Eq.—Faringite traumatica.

Definition.—Acute, often œdematous, inflammation of the pharynx, caused by swallowing boiling water or caustic substances, inhalation of flame, etc.

Etiology.—Traumatic inflammation of the pharynx is most commonly met with in children, as the result of an attempt to drink boiling water from the spout of a kettle.[1] Swallowing corrosive liquids, either accidentally or purposely, is also a common cause of the malady. In many of such cases, however, the symptoms of the pharyngeal injury are lost in the graver phenomena arising from œdema of the glottis or severe lesion of the alimentary canal. Inflammation of the pharynx is sometimes caused by the inhalation of hot air or flame, as may occur to persons who, in the case of fire, are obliged to remain for some time in the burning building before being rescued.[2]

Symptoms.—Pharyngitis, as the result of any of the above causes, is accompanied by all the signs of intense inflammation, with extreme odynphagia and urgent dyspnœa. The morbid process may terminate in suppuration of the connective tissue of the neck,[3] and even in gangrene of the affected parts, but, according to Bamberger,[4] the latter issue is an extremely rare one. In many instances of this kind of injury the pharyngeal affection is almost unimportant, as forming merely a part of a deep and extensive inflammation which involves the larynx and œsophagus. With respect to corrosive poisoning, the symptoms produced by the various drugs that act in this way have a considerable resemblance, and accurate conclusions as to the particular poison can seldom be arrived at in individual cases without a chemical analysis of the contents of the stomach, etc. The following details may, however, be given as to the physical condition of the pharynx when acted upon by those caustic substances most commonly swallowed by accident or taken with suicidal intent.

Sulphuric Acid.—At first the mucous membrane of the mouth and pharynx presents a parchment-like aspect, or looks as if it had been smeared with thin arrowroot.[5] Gradually it becomes darker, and, turning to a brownish color, separates in shreds or extensive layers.[6] When the vessels are reached, the blood is charred and resembles blacking.[7] The pain

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[1] See a paper on this subject by Jameson : Dublin Quart. Journ. of Med. Sc., February, 1848 ; and a more recent one by Bevan : Dublin Med. Journ., November, 1866.

[2] Solis Cohen : Inhalation, its Therapeutics and Practice, p. 294 (Report on ten patients), Philadelphia, 1867.

[3] Stroppa : Gazzetta Lombarda, No. 35, 1871.

[4] Handb. d. Spec. Path. u. Therap., Bd. vi. Abth. i. p. 10.

[5] Taylor On Poisons, p. 178, London, 1875.

[6] In a case seen by Galtier (Toxicologie, vol. i. p. 199), a piece of mucous membrane representing the entire lining of the gullet for a distance of nine inches was expelled at once.

[7] See a case by Gull : Med. Gaz., 1850, vol. xlv. p. 1102.

is severe, but sometimes does not come on for several hours after the poison has been swallowed.

Nitric Acid acts much like sulphuric acid, but the pain is almost always an immediate symptom. The mucous membrane is whitish and soon becomes of a citron color, especially over the tonsils.

Hydrochloric Acid.—The mucous membrane is highly inflamed, but otherwise does not show much alteration. The surface of the tongue is generally reduced to a pulp.

Oxalic Acid.—The mucous membrane looks white and softened, and the small vessels are filled with blackened blood. According to Christison,[1] this acid acts as a poison independently of its corrosive properties, by causing paralysis of the heart.

Carbolic Acid causes the mucous membrane to become white, corrugated, and hardened.

Caustic Potash and Soda have very similar effects, and are not unfrequently taken in the form of *soap lees*. The mucous membrane is softened, detached, and inflamed, whilst numerous patches of a chocolate color, almost black, are perceived. In a case seen immediately after its occurrence by Dr. Deutsch[2] the mucous membrane was of a bluish red color, bled on being touched, and separated quickly in shreds.

Caustic Ammonia acts much in the same way as potash or soda, with this difference, that the *pain* is immediate, and much greater in severity. The mucous membrane is blackened.

Phosphorus acts as a general irritant, and also causes redness of the mucous membrane of the throat. The breath has a strong odor of garlic.

Tartar Emetic causes soreness of the mouth and throat, with aphthous-like crusts, which are at first white, but afterward become brown or black.

Chloride of Zinc (in the form of Burnett's disinfecting solution) has a strongly corrosive action on the mucous membrane of the throat, which is white and thickened, and has a strongly destructive action.

Corrosive Sublimate causes the mucous membrane to become white and shrivelled, and gives rise to violent throat symptoms, almost immediately on being taken.

Arsenic acts as a general irritant and has no corrosive action, whilst the symptoms of poisoning do not come on for some time after the dose has been taken.

Nitrate of Silver.—The whitish appearance of the mucous membrane, when touched by this substance, is well known. It acts as a powerful local irritant.

Muriated Tincture of Iron causes inflammation and swelling of the mucous membrane, and distressing urinary symptoms.

Various *saline substances*, such as *nitrate of potash, oxalate of potash, salts of lead or copper*, etc., cause inflammation in the pharynx when taken in concentrated forms, and act as powerful poisons.

Prognosis.—The prognosis, of course, depends on the amount of injury done to the tissues of the pharynx, larynx, and œsophagus, and on the constitutional effects produced by the poison. In slight cases where the pharynx alone has been touched by the local irritant, there is generally a good prospect of recovery, but always a risk of subsequent contraction of the pharynx. If the larynx is affected, there is danger of *immediate* death from œdema of the glottis and asphyxia. Should the œsoph-

[1] On Poisons, p. 219.

[2] Berliner Med. Zeitung, No. 51, 1857.

agus be much injured, the prospects of a fatal termination are usually more remote, but not less certain, from stricture of the gullet and marasmus.

Treatment.—It does not come within the scope of this article to indicate the various remedies that may be administered as antidotes, in order to neutralize the caustic effects of corrosive substances. It may be useful to mention, however, that as the action of the irritant poisons is very rapid, but little benefit can be expected from drugs which have the property of rendering them chemically inert when in a free state.

The best treatment that can be pursued in cases of traumatic pharyngitis, is one of a purely anodyne and emollient character. Opium or morphia should be given in full doses by the mouth or hypodermically, whilst the local medication of the part is best effected by the insufflation of morphia, gr. $\frac{1}{4}$ to gr. $\frac{1}{2}$ twice or three times a day. Hot, soothing inhalations (Throat Hosp. Phar.) may also be used with advantage, but gargles are usually inadmissible, as the least movement of the fauces causes severe pain. The difficulty of feeding the patient is often great, owing to the intense odynphagia, whilst an œsophageal tube cannot be used because the softened state of the tissues renders perforation of the gullet by the instrument almost unavoidable. As soon as the sloughs have separated, and the diseased surface has assumed the character of healthy ulceration, the mucous membrane can be brought into a healthy state by the application of astringent solutions, such as the pigmenta of iron, zinc, or nitrate of silver.[1]

ANGINÆ CAUSED BY POISONOUS DRUGS.

Latin Eq.—Anginæ venenis ortæ.
French Eq.—Angines toxiques.
German Eq.—Toxische Anginen.
Italian Eq.—Angine eccitate da droghe velenosi.

Definition.—Morbid conditions of the pharynx caused by the action of mineral or vegetable poisons taken internally.

1. *Mercury.*—Amongst the ill consequences sometimes arising from impregnation of the system with mercury is a species of pharyngeal inflammation characterized by redness of the mucous membrane, ulcers with a grayish colored surface, and considerable dysphagia. At the same time the mouth and tongue are generally similarly affected, and ptyalism is usually present. This disease is most commonly met with in gilders, in persons employed in quicksilver mines, and in patients who have undergone medical treatment. The history of the case affords the best aid to diagnosis, and the local lesions generally yield after a time to the use of astringent gargles, and the internal administration of chlorate of potash —provided, of course, that the cause of the affection has been removed.

2. *Antimony.*—Tartrate of antimony, when given constantly for a few days in a concentrated form, has a very irritating effect on the mucous

[1] Throat Hosp. Phar.

membrane of the pharynx. The patient complains of heat, and a painful sense of tension in the throat, whilst swallowing is rendered extremely difficult. On inspection the pharynx appears red and swollen, and often covered with aphthous ulcers. A like condition generally prevails at the same time in the mouth. Spontaneous resolution occurs in a few days after the administration of the remedy has been discontinued. The affection should be treated by gargles containing alum, sulphate of zinc, or hydrochloric acid, whilst the occurrence of the accident may be prevented by exhibiting the antimony in the form of pills.

3. *Iodide of Potassium.*—This drug exerts a special effect over the mucous membranes of the nose, conjunctivæ, and pharynx. In some persons, as is well known, a single small dose is sufficient to cause a violent coryza with incessant sneezing, and a sensation of painful tension and dryness in the throat. These symptoms are occasionally accompanied by salivation, and there is sometimes slight odynphagia. The attack resembles, in a considerable degree, an exacerbation of influenza, but in some cases the phenomena are almost confined to the pharynx and the salivary glands. On inspection no lesions are discernible, beyond superficial redness of the mucous membrane, and the affection subsides spontaneously on suspension or diminution of the dose of the remedy. The injection of tincture of iodine into a serous cavity is capable of producing a similar set of symptoms.

4. *Arsenic, Copper, Lead, Zinc, etc.*—The salts of all these metals, when taken as medicines, or introduced in any way in small doses into the system, have more or less power of causing hyperæmia and superficial inflammation of the mucous surfaces.

5. *Belladonna.*—This vegetable, as well as most of the other members of the natural family of Solanaceæ, is capable, when taken in an overdose, of producing painful throat symptoms. Heat in the pharynx and difficulty of swallowing are present, and there is considerable congestion of the mucous membrane. These phenomena are accompanied by dilatation of the pupils, and more or less disturbance of the intellect. The condition should be met by the use of emollient and sedative gargles, and when there are general symptoms of intoxication, by the use of stimulants —especially strong coffee.

WOUNDS OF THE PHARYNX.

Latin Eq.—Vulnus pharyngis.
French Eq.—Plaies du pharynx.
German Eq.—Wunden des Schlundes.
Italian Eq.—Ferite della faringe.

Definition.—Solutions of continuity of the walls of the pharynx caused by violence.

Etiology, Symptoms, etc.—The pharynx is chiefly liable to be wounded, in suicidal and homicidal attempts, when the throat is cut or stabbed. Wounds inflicted by drawing a knife across the throat are almost always situated below the hyoid bone, as above this level the fleshy base of the

tongue intervenes so as to prevent the instrument penetrating so far as the pharyngeal cavity. The wound is often in the thyro-hyoid space, and not unfrequently the epiglottis is partially divided. Profuse hemorrhage from some of the numerous large vessels generally occurs, and the incision gapes considerably, especially if the head is raised. Mucus, saliva, as well as blood, escape from the wound, and attempts at deglutition are followed by the extrusion of part or even the whole of the ingesta through the aperture.[1] Dysphagia is present from the first, but there is seldom any dyspnœa or alteration of voice, unless the larynx is simultaneously injured or subsequently becomes implicated by extension of inflammation. It is just possible, however, that a severed fragment of the epiglottis or one of the arytenoid cartilages may drop into the larynx, and act as a foreign body.[2] Should there be much hemorrhage into the pharynx, the blood may pass into the air-passages and speedily give rise to fatal asphyxia.

Wounds of the pharynx sometimes occur in a direction from within outward, articles held in the mouth, such as pipe-stems, pen-holders, pencils, spoons, etc., being accidentally driven violently backward and thrust through the walls of the cavity.[3]

Treatment.—The first object to which we must direct our attention is the arrest of hemorrhage, if such be present. When the bleeding is considerable, and cannot be restrained by pressure, it may be necessary to cut down upon, and ligature, one of the carotid arteries. If there be no accompanying wound of the air-passages, the edges of the incision may be united by sutures, whilst the head is maintained in a suitable position by means of pillows, bandages, and plasters. When a portion of the epiglottis is partially severed it is advisable to remove it entirely, rather than to attempt to unite it by sutures, as absence of this organ is attended by little functional inconvenience. Should œdema of the glottis occur, it will of course be necessary to resort to tracheotomy. During cicatrization of the pharyngeal wound the patient must be fed by the aid of a tube passed into the upper part of the œsophagus. If this mode of giving food occasions spasm of the glottis, and irritates the throat generally, it is advisable to administer nourishment to the patient by means of nutritive enemata. Perfect rest of the parts is thus almost secured, and the dangers of such cases are materially lessened. Should extensive traumatic inflammation of the pharynx occur, it must be treated on general principles. In all cases of wounds of the pharynx, where the act of deglutition is not contraindicated, the continual sucking of ice is a good local safeguard against subsequent inflammatory action.

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[1] Moore: The Lancet, 1864, vol. ii. p. 287.

[2] Gant: The Science and Practice of Surgery, London, 1871, p. 828.

[3] Macleod: Cooper's Dict. of Pract. Surg., London, 1872, vol. ii. p. 452; Med.-Chirurg. Transact., vol. xxix. p. 38; and Durham: Holmes' System of Surgery, vol. ii. p. 457.

FOREIGN BODIES IN THE PHARYNX.

Latin Eq.—Corpora adventitia in pharynge.
French Eq.—Corps étrangers dans le pharynx.
German Eq.—Fremdkörper im Schlundkopf.
Italian Eq.—Corpi stranieri nella faringe.

Definition.—Foreign bodies introduced into the pharynx from without, and arrested there by being lodged in recesses, or by becoming impacted in a wall of that cavity.

Etiology.—Foreign bodies often become arrested in the pharynx. The substances which have been most frequently found lodged there are lumps of meat, fragments of bone, and entire fish-bones, bristles, leeches, false teeth, buttons, coins, pins, and needles. I have, at different times, removed every one of the bodies named, except leeches. Occasionally persons are met with who appear to have a special predisposition to the lodgement of foreign bodies in the pharynx, resulting either from carelessness in eating, impaired sensibility of the mucous membrane, or from some unusual irregularity of the walls of the pharynx, which causes substances to be easily entangled and arrested. Large foreign bodies generally become lodged at the lower part of the cavity, where the cricoid and arytenoid cartilages project backward, or between the base of the tongue and the epiglottis. Small and sharp pointed bodies may become fixed at any part of the pharynx, but are usually found sticking into the tonsils, which, on account of their uneven surface, are especially likely to arrest passing substances; small substances may also be entangled in the pillars of the fauces, or in the lateral folds of the cavity. Sometimes a large or long body, as a needle or fish-bone, is found stretching across the entire width of the pharynx. With respect to leeches, these animals have generally found their way into the throat in the case of travellers who, being overcome by thirst, have been obliged to drink ditch-water. Numerous instances of this kind, accompanied by sudden and alarming symptoms, have been observed and reported by practitioners from a very early date, Hippocrates himself giving detailed advice as to the proceedings to be adopted in such a contingency.[1]

Symptoms.—Small pointed substances generally occasion much discomfort, especially during deglutition, although respiration is not interfered with unless considerable inflammation is set up. Fragments of hard substances, such as bone, may cause ulceration or abscess of the pharynx,[2] but they more often merely give rise to localized inflammation and troublesome irritation. When an abscess occurs fistulous openings may be formed in the neck, through which the foreign body may eventually be expelled. Foreign bodies sometimes give rise to great danger, and may even cause death from perforation of a large blood-vessel, or the foreign body may penetrate the intervertebral substance and cause caries of the bodies of the vertebræ.[3] Bell [4] has reported the case of a lad who,

[1] Breschet: Dict. des Sciences Méd., 1813, vol. vii. p. 16.
[2] Moore: Loc. cit.
[3] Fleury et Schupfe: Nouveau Dict. de Méd. et de Chir., vol. i. p. 297.
[4] Medical Gazette, 1842–43, p. 694.

having swallowed a sewing needle with his food, died on the tenth day afterward from hemorrhage. At the autopsy the needle (three inches long) was found fixed transversely across the pharynx, the wall of which it had perforated opposite the middle of the thyroid cartilage whilst the point was lying in the common carotid artery. The larynx, trachea, and stomach were found filled with clotted blood. A somewhat similar case is related by Fingerhuth,[1] in which a piece of the stem of a long tobacco pipe became lodged in the side of the pharynx, and after an interval of eight months occasioned fatal hemorrhage by wounding the carotid in a sudden movement of the head. In some cases swallowing becomes so painful that deglutition is rendered almost impossible. When a large foreign body is impacted in the pharynx, the chief danger arises from the probability of suffocation on account of the entrance to the larynx being obstructed. In rare instances the foreign body may become impacted in such a way as to press down the epiglottis and occasion sudden death. In such a case the patient appears to die in a fit of apoplexy.

If a patient complain of a foreign substance being arrested in the pharynx, a view of the parts can sometimes be obtained by placing the individual with his mouth open opposite a window, directing him to take a forcible inspiration, and pressing down the tongue with the finger. In most cases, however, the laryngoscope must be made use of, as by this appliance alone is it possible to inspect the whole of the pharyngeal cavity. When the parts are thoroughly examined in this way, it is rare that a foreign body, however small, escapes notice; but when nothing can be seen, further examination should be made with the finger, as it is possible that a small, pointed, semi-transparent body, such as a fish-bone or bristle, may in this manner be detected. Even coins have been discovered imbedded in the folds of mucous membrane which pass from the sides of the pharynx to the larynx, after having remained undetected for a considerable time in this position.[2] Thus a case is recorded in which a halfpenny remained in the pharynx of a child eight months, and was ultimately brought up after a fit of coughing.[3] In rare instances foreign bodies may get into the pharynx by penetrating the structure of the neck. In illustration of this fact an instance is on record in which a surgeon removed from the pharynx of a woman a sewing needle, which had been thrust into her neck half an hour previously.[4]

Diagnosis.—The history of the case, and inspection of the pharynx, will generally afford conclusive evidence as to the nature and position of the foreign body. It must be remembered, however, that the substance may sometimes have been swallowed or ejected a short time after its lodgement, though the patient may still continue to experience a sensation as if something were sticking in his throat. When the pharynx is unusually sensitive, or especially when a particular spot on its walls is in an irritable condition, a patient after taking food is very likely to imagine that something has become fixed in the throat. Hysterical women are particularly prone to become possessed with such an idea, and to persist in it for weeks or months in spite of all assurances as to the groundlessness of their delusion. Again, with respect to children, serious symptoms, due to the impaction of a foreign body in the throat, may be pres-

[1] Preuss. Vereinszeitung, N. F. vii. No. 23, 1864.
[2] Durham: Holmes' System of Surgery, vol. ii. p. 519.
[3] Ogier Ward: Trans. Path. Soc., 1848–49.
[4] Jardine Murray: Med. Times and Gazette, 1859, p. 468.

ent, whilst the history of the case does not afford the slightest clue to the origin of the phenomena.

Prognosis.—If the foreign body can be removed, the prospect is of course perfectly satisfactory, but if it remain in the throat, the prognosis must depend on its size and nature. Thus a large body may threaten death from suffocation, and a small one may give rise to a fatal result by penetrating a vital part. A sharp body, such as a bone, is more dangerous in its remote consequences than a smooth one. Rokitansky[1] thinks that the impaction of small hard bodies, such as cherry stones, at the lower part of the pharynx may cause the formation of a diverticulum.

Treatment.—The pharynx being as thoroughly accessible to instruments as it is to vision, foreign bodies, lodged in its cavity, can generally be easily removed. Large pieces of soft substances, such as lumps of meat, may be seized with the fingers or with forceps and extracted, or they may be pushed down into the gullet with a probang. Coins can be removed with forceps, or if they are impacted at the orifice of the œsophagus the money-probang may often be used with success. Small pointed bodies, such as fish-bones, bristles, pins, etc., imbedded in the substance of the tonsils, or entangled in the folds of mucous membrane, are best seized by suitable forceps, and drawn out in the direction of their long axis. Plates of artificial teeth can usually be most easily extracted by the aid of forceps. When summoned to a patient who is almost suffocated, it may not be possible to make a thorough exploration of the throat, and tracheotomy may be immediately necessary. The common, but fatal, practice is at once to use a probang, and to force the obstructing object onward. A foreign body, comparatively harmless in the pharynx, is thus often driven into the larynx or even into the bronchi, or may become impacted in the œsophagus.[2] At the same time great injury is often done to the soft parts. If the patient's respiration could support a probang, an inspection could certainly be made; but if he appear to be dying of apnœa, tracheotomy may be necessary before the extraction of the foreign body can be accomplished. When no foreign substances can be detected after careful examination, it is advisable, even though the patient's sensations lead him to believe that the cause of his trouble is not removed, to wait for some little time before subjecting him to further manipulation. For the sensations of the patient are often unreliable, and although the foreign substance may have been extracted, a feeling of heat, pricking, or constriction in the pharynx, may be experienced for some time afterward. Such sensations deceive the sufferer by simulating the presence of some offending substance. By leaving the parts at rest, if there be any foreign body in the pharynx, it will often work its way out, and be swallowed or ejected by the mouth, or it can be subsequently removed. As a rule, the sensations which remain after the extraction of a foreign body, generally subside in a few hours, although in some cases they persist for several months, and cause the utmost misery. There is usually some hyperæmia, and probably also a morbid condition of the terminal nerve-fibres. Such cases are frequently difficult to cure. The application, however, of astringents to the mucous membrane, and the employment of galvanism, usually relieve the symptoms after a time. In some instances change of air and scene is necessary in order to dispel the impression, and travelling should be recommended. In ordi-

[1] Pathological Anatomy (New Syd. Soc. Trans.), vol. ii. p. 12.
[2] Schrötter: Medical Examiner, March 23, 1876.

nary cases the discomfort remaining after the removal of a foreign body from the pharynx will be much alleviated by directing the patient to sip a little iced water from time to time, or to suck and swallow small pieces of ice. It must not be forgotten that occasionally two foreign bodies—especially fish-bones—may be present at the same time in the pharynx without the patient being aware that there is more than one substance. Hence, if the sensations remain after the removal of the foreign body, a further examination should be made. A remarkable instance of this occurred to me a few years ago. An eminent Glasgow surgeon consulted me on account of a fish-bone which had become lodged in his throat three or four months previously. I succeeded in removing a fish-bone from the lower part of the pharynx. I told him that "he might feel the sensation for a day or two, but that there could be nothing more in the throat." Two days afterward the gentleman returned to me, saying that he felt sure there was another bone near the site of the one I had removed, and on making examination I found that his sensations were accurate, and that a second bone was lodged in the throat at the spot indicated. On its removal, no further unpleasant feelings were experienced. It may be remarked that, between the removal of the first and second bone, the patient had not partaken of any fish.

NEUROSES OF THE PHARYNX.

Latin Eq.—Neuroses pharyngis.
French Eq.—Névroses du pharynx.
German Eq.—Neurosen des Schlundes.
Italian Eq.—Nevrosi della faringe.

Definition.—Disordered sensibility of the mucous membrane of the pharynx, or a perverted or impaired action of the pharyngeal muscles, due to central or local disease of the nervous system.

Nervous affections of the pharynx are divided into neuroses of sensation and neuroses of motion.

Neuroses of Sensation.

Under this head four conditions of the mucous membrane in which the sensibility is altered may be grouped, viz., anæsthesia, hyperæsthesia, paræsthesia, and neuralgia.

Anæsthesia.—This neurosis is generally of little clinical importance, but occasionally, according to Krishaber,[1] diminished sensibility is one of the earliest symptoms of progressive bulbar paralysis. It is nearly always present in diphtheritic paralysis. In insane patients[2] it may occasionally, however, be found to exist without any motor disturbances, or may result from the action of certain drugs, such as morphia or chloroform applied locally. To cure the affection, galvanism may be applied to the part, and strychnine administered internally or introduced hypodermically.

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[1] Gazette Hebd., 1872, p. 772.
[2] Ziemssen's Cyclopædia, vol. vi. p. 993.

Hyperæsthesia.—Abnormal sensibility is of much more frequent occurrence than the affection just described. It is met with very frequently in individuals otherwise perfectly healthy, and often forms one of the greatest difficulties the laryngoscopist has to contend with in order to obtain a view of the interior of the larynx. The introduction of the Eustachian catheter may also be rendered impossible on account of hyperæsthesia in the pharyngo-nasal region. It may be useful to mention here that even in the normal condition there is a considerable difference in the sensibility of various parts of the pharynx. Thus it is greatest on the arch of the palate, whilst the posterior wall of the cavity may generally be touched without provoking any reflex action. Every variety of hyperæsthesia may be met with in hysterical women, whilst an increased sensitiveness of the parts generally accompanies inflammatory conditions, acute or chronic. No special measures are demanded for the cure of hyperæsthesia of the pharynx, except when the practitioner requires to pass instruments into the cavity for the examination or local treatment of the adjacent parts. These will be described in the article on "Laryngoscopy."

Paræsthesia.—This condition may occur without any overt cause in hysterical women, but it generally follows the removal of a foreign body. The patient complains of something sticking in the throat, such as a hair, a fish-bone, or a rough fragment of some hard substance. When this morbid sensation is consequent on the previous lodgment of a foreign body it generally passes away spontaneously in a day or two; but, sometimes, it may remain for months—or even years, as already explained under "Foreign Bodies in the Pharynx." When dependent on hysteria, the general measures usually adopted for the relief of the complaint should be employed.

Neuralgia.—This affection of the pharynx has not hitherto been accurately described. Türck,[1] however, mentions some half-dozen examples (four occurring in females) where severe pains of the soft palate, principally on one side, were complained of. The affection appears to have been incurable in one instance, whilst the rest recovered in a few weeks under the influence of strong applications of nitrate of silver. Some of these cases, however, approached more nearly to simple hyperæsthesia or paræsthesia than to veritable neuralgia.

Many instances of this disease have come under my notice. In most of the cases the patients were young girls under twenty, but I have met with the affection in married women between thirty and forty. In some of these cases there was anæmia, and more rarely chlorosis, but many of the patients were otherwise healthy. In most of the cases the patients were not in the least hysterical. Sometimes there was local hyperæmia: sometimes anæmia. In the former cases, free scarification proved very useful. In nearly all instances applications of tincture of aconite, three or four times a day, were of the greatest benefit, and this drug has often proved, in my hands, the only remedy which gave relief.

Neuroses of Motion.

Spasm.—This symptom is rarely met with except in cases of acute œdema of the uvula, intense pharyngitis, and hydrophobia. The con-

[1] Wiener Allgem. Med. Zeitung, No. 9, 1862.

strictors of the pharynx, however, often participate more or less in spasmodic stricture of the œsophagus. Twitching movements of the palate, according to Wagner,[1] also occur in advanced cases of *paralysis agitans*. Thus, in a patient suffering from constitutional syphilis and paralysis of one half of the body (the palate not being involved), Wagner observed movements, synchronous with the pulse, on one side of the palate.

Paralysis.—There are four kinds of paralysis of the palate and pharynx:—(1) the affection, which is a frequent sequel of diphtheria, and occasionally met with after common angina; (2) the slight paralysis which is sometimes associated with facial paralysis; (3) the loss of power, which is one of the most marked phenomena of progressive bulbar paralysis; and (4) paralysis of the constrictors of the pharynx, which is always associated with a similar condition of the œsophageal canal.

Diphtheritic paralysis of the palate is a common sequel of membranous sore throat. An analogous affection, however, sometimes follows a simple angina, and may perhaps arise from mere debility. Cases of the former kind have been reported by Drs. Gubler,[2] Broadbent,[3] Hermann Weber, Silver, and others; and Dr. Broadbent [4] has recorded an instance in which the disease (associated with loss of power of the abductors of the vocal cords and slight dysphagia) arose spontaneously in a child six years of age. It is probable that inflammatory disease of the pharynx, such as tonsillitis, general pharyngitis, putrid sore throat, or syphilis, may give rise to more or less disturbance of the motor apparatus of this region; but it is only in diphtheria that other nerve-centres suffer, so that this fact affords a means of differential diagnosis. The voice acquires a characteristic nasal timbre, the modification of certain articulate sounds being very characteristic, owing to the impossibility of closing the naso-pharyngeal passage. Thus *rub*, *head*, and *egg* become *rum*, *hent*, and *enk*.[5]

On inspection, the velum pendulum palati and uvula are seen to be relaxed, and although during inspiration and expiration the uvula moves backward and forward under the force of the current of air, the power of voluntarily raising it is, to a great extent, lost. This feature is generally unilateral, and when bilateral it always affects one side much less than the other, giving rise to a mere paresis of the muscles on the side least affected. There is also generally loss of sensibility in the veil of the palate. The affection usually comes on about a fortnight after the commencement of convalescence, and is sometimes followed by general paralysis or paresis of the muscles of the extremities. The patient first perceives the difficulty of swallowing, in taking fluids, which frequently regurgitate through the nose or pass into the larynx. This symptom is partly due to the implication of the depressors of the epiglottis. The power of expectoration is often lost, and mucus accumulates about the lower part of the pharynx, and is only dislodged by an effort of vomiting. The taste is always more or less blunted. In some cases a constant pricking sensation is felt in the throat. Some illustrative cases will be found under "Neuroses of the Larynx," and the various associated paralyses which occur in diphtheria are briefly described in the article on that subject.

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[1] Ziemssen's Cyclopædia, p. 993.
[2] Loc. cit.
[3] Lancet, March 4, 1871.
[4] Clin. Soc. Trans., 1871, p. 92.
[5] Donders: New Sydenham Soc. Trans., 1864.

Galvanism and faradism should be applied every day or two, by means of the laryngeal electrode, until a decided amelioration of the symptoms is obtained. At the same time general tonics are indicated, and strychnia may be administered, either hypodermically or by the mouth. The patient should only be allowed to swallow *panada*, soups made almost solid by the addition of corn flour, and very firm wine jellies. Occasionally it may be necessary to feed with the œsophageal tube, or *per rectum*.

Paralysis of the palate in association with facial paralysis occurs, according to Erb,[1] when the cause of paralysis is situated above the geniculate ganglion. The uvula usually deviates to one side or the other—generally to the healthy side, and scarcely moves in phonation. This nerve-lesion does not require any special treatment, as it is merely an unimportant though interesting phenomenon sometimes occurring in connection with facial paralysis.

Palato-glosso pharyngeal paralysis is always one of the most marked phenomena of progressive bulbar paralysis. The disease is said to be rarely met with before the age of forty, but I have treated patients aged twenty-seven, twenty-nine, and thirty-eight. Exposure to cold is often the cause of the disease, but it has been likewise attributed to prolonged mental excitement, bodily fatigue, and insufficient nourishment. The malady commences in the tongue, next affects the lips, and soon after the palate and pharynx. There is indistinctness and slowness of speech at an early period of the disease from the imperfect mobility of the tongue, but before long the labial consonants and vowels cannot be properly formed, and all words in which *p b v f m* occur, and those commencing with *w y o u*, are indistinctly pronounced. As the disease progresses, speech becomes quite unintelligible, and dysphagia, which at a very early stage is present to a slight extent, becomes so severe that the patient can scarcely take an atom of food or a drop of fluid. His saliva cannot be swallowed, and dribbles from the mouth. The extreme dysphagia is partly due to the paralysis of the constrictors and partly to paralysis of the epiglottis, which, being unable to close over the larynx, permits the ingesta to enter the air-passage. The salivary secretion cannot be swallowed, and is at the same time absolutely increased in quantity. The patient can often only sleep sitting in a chair, with his head resting on the table, so that the saliva may run out of the mouth. If by chance, during sleep, the saliva reaches the larynx, the patient awakes with a fearful attack of spasm of the glottis.

The disease consists essentially in degenerative atrophy of the gray nuclei in the floor of the fourth ventricle, in sclerotic changes in the medulla and spinal cord, and in atrophy of the paralyzed nerves and muscles.

The disease is probably always fatal, the cases of supposed recovery from progressive bulbar paralysis having most likely been due to pressure on the medulla. Life is so distressing whilst it lasts, that the duty of the physician is to promote the euthanasia.

Paralysis of the constrictors is characterized by dysphagia, and loss of power of the œsophagus always coexists. The same treatment is required as that hereafter recommended for the œsophageal affection.[2]

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[1] Ziemssen's Cyclopædia, vol. xi. p. 496.

[2] This completes the list of diseases of the pharynx proper. Those which follow generally attack the pharynx in common with the mucous membrane of the adjacent parts.

APHTHÆ.

(Synonym: Thrush.)

Latin Eq.—Aphthæ.
French Eq.—Aphtheuse. Muguet.
German Eq.—Schwämmchen Aphthen.
Italian Eq.—Afte.

Definition.—Inflammation of the mouth and throat characterized by the presence of whitish vesicles or ulcers, which frequently serve as a nidus for parasitic fungi.

Etiology.—Aphthous spots are occasionally met with in the pharynx, though they are more common in the mouth. The affection is most frequently met with in new-born infants, and in these cases acidity of the stomach is almost always present; but it also occurs in the last stages of debilitating diseases, especially phthisis, and is occasionally met with as a sequela of measles. Aphthous affections are much oftener seen in cold, damp climates than in warm and dry regions. A low state of the system appears to be the most important factor in the production or predisposition to aphthæ. According to Fabre [1] the autumn season is most favorable to the occurrence of the disease.

Symptoms.—Small white spots or patches about the size of a pin's head are seen in the greatest number on the inside of the lower lip and cheeks, on the sides and under surface of the tongue, on the tonsils, and on the veil of the palate. Two stages can sometimes be recognized in the course of aphthæ, viz., a *vesicular* and an *ulcerative* condition, but sometimes there is a small patch of exudation from the commencement. The vesicles first appear as small elevations or papules, of a red color, hard, and painful. They quickly become white at their summits, and are distended by a fluid which soon ruptures the vesicles. Small superficial ulcers, with steep sides and a grayish white floor result. The floor is covered by pultaceous matter, which is constantly secreted and thrown off—sometimes in large quantities. When the ulcers are about to heal they lose their whitish aspect, and the circumference gradually narrows, until a livid speck on the mucous membrane is the only trace of the former presence of the aphthæ. Sometimes the lining membrane of the mouth and throat looks as if it had been dusted over with flour—the whole of the mucous membrane being covered with minute white specks. When the spots and ulcers are very numerous they become confluent, and in some cases successive crops of vesicles continue to come out for several weeks. Great soreness of the mouth and fauces accompanies aphthæ, and in many cases a marked febrile condition of a sympathetic nature is excited by the malady. In the case of infants there is often diarrhœa with flatulency and colicky pains.

Diagnosis.—Separate spots of aphthæ are not likely to be mistaken, but when the disease is confluent the appearance of a false membrane is simulated, and close examination will be necessary, in order to diagnose

[1] Dict. des dict. de Méd.

between this malady and diphtheria. The whitish pultaceous matter which breaks up on being touched can be easily distinguished from the homogeneous, closely adherent, and tough membrane of well marked diphtheria, but there are some cases which occupy a middle ground and are very difficult to differentiate.

Pathology.—The nature of the affection has to a great extent been explained in speaking of the symptoms. It remains only to be added that a special fungus, the *oidium albicans*, is often met with in great quantities in the whitish cord-like matter which characterizes the disease.

Prognosis.—In infants aphthæ seldom cause death, but in rare cases the œsophagus may become ulcerated to such an extent as either to render swallowing impossible or to provoke ejection of food as soon as it reaches the stomach. In the last stage of debilitating diseases aphthæ generally constitute an unmistakable sign of approaching dissolution.

Treatment.—In the case of infants it is very important to attend to the diet, which, if possible, should consist of the mother's milk alone. Lime water, or the alkaline carbonates, are often of great service. As an internal agent chlorate of potash appears to exert a remarkable influence in hastening the disappearance of the aphthæ. Five or six grains may be given every four hours. Pernitrate of iron may also be used advantageously as an internal remedy. A general tonic and analeptic treatment will always be required in addition to other measures. The Mel Boracis, P. B., or borax diluted with white sugar (1 in 10), is an excellent remedy in the case of children. A pinch of the latter mixture should be placed at the back of the child's tongue, and allowed to dissolve. The pain and soreness are usually much relieved by the frequent use of honey or glycerine, with borax. Equal parts of glycerine and turpentine are very beneficial in the later stages. The ulcers can often also be successfully treated by daily application of sulphate of copper (gr. x. ad ℥ j.). In the case of adults where there is great soreness, free cauterization with the solid stick of nitrate of silver affords immediate and marked relief. Sir William Jenner [1] first pointed out that in cases where a parasitic fungus is present a lotion of sulphite of soda (a drachm to the ounce) will kill the parasite, and thus cure the disease in about twenty-four hours.

DIPHTHERIA.[2]

Synonyms.—Several pages might be written of synonyms which at different times have been employed in describing diphtheritic affections, but simple inflammatory diseases, distinctly pellicular affections, and le-

[1] Med. Times and Gaz., vol. vii. p. 183.

[2] Inasmuch as a diphtheria generally commences in the pharynx, and when it affects other parts, most frequently attacks them by extension, I have thought it right to treat the whole disease in this section. I am the more inclined to adopt this plan as I entertain the view that croup is only a form of diphtheria in which the local expression is found in the larynx and trachea—as it often is in the nares (with or without its occurrence in other parts). This proposition will be developed in the body of the article in some detail, and I have only to remark here that, by sacrificing the strictly anatomical arrangement of the work in this instance, I hope to give a better idea of the disease as an entity, than I could do if I treated the diphtheritic affections of the larynx and nose in separate sections.

sions of innervation have been so confused together by the earlier writers in medicine, that there is little or no advantage to be gained by collecting the numerous synonyms employed by different authors at various times. The term *diphtheritis* was originally suggested by Bretonneau, who, observing that the disease was differentiated from other similar maladies by the formation of a false skin or membrane, coined the word *diphthérite* from the Greek διφθέρα, a skin or parchment, and *ite* from ἴτης (εἶμι), hasty, impetuous, the well-known termination used in medicine to imply inflammation. Trousseau subsequently modified the word to *diphthérie*, in order to get rid of the etiological doctrine of inflammation which the affix indicated, and the term *diphtheria* was adopted by our Registrar-General. Names indicative of inflammation still hold their ground, however, amongst German and Italian writers.

Latin Eq.—Cynanche membranacea; C. maligna; C. pharyngea maligna; C. pharyngea epidemica; C. trachealis. Angina suffocativa; A. polyposa; A. membranacea; A. perniciosa. Diphtheria. Diphtheritis.
French Eq.—Angine couenneuse; A. fibrineuse. Diphthérite. Diphthérie.
German Eq.—Diphtheritische Entzündung der Rachen- und Kehlkopfsschleimhaut.
Italian Eq.—Mala in canna. Difterite.

Definition.—A specific communicable disease, occurring epidemically, endemically, and solitarily,[1] and characterized by more or less inflammation of the mucous membrane of the pharynx, larynx, or air-passages, and by the formation on the surface of those parts—especially on the mucous membrane of the fauces and windpipe—of a layer or layers of lymph or false membrane, generally showing signs of bacteroid mycosis. During an epidemic other mucous surfaces exposed to the air, and wounded surfaces of the common integument occasionally, but less frequently, become covered with a layer of lymph, subsequently to, or independently of, a formation of membrane in the more ordinary situations. The disease is generally of an adynamic character, is often associated with a disturbance of the renal function (albuminuria), and is frequently followed by lesions of innervation rarely giving rise to permanent paralysis. The symptoms as regards respiration, vocalization, and deglutition vary with the site of the disease. By far the larger proportion of fatal cases terminate by gradual apnœa, but a certain percentage sink from asthenia, blood-poisoning, and cardiac thrombosis.

History.—The presence of a membraniform deposit in the fauces seems to have been regarded as a morbid condition, attended with considerable danger to life, from the earliest times. Hippocrates is supposed to have called attention to it more than two thousand years ago, and Aretæus has given a description which answers in many respects to the disease as now seen. But centuries before the time of Hippocrates an Indian writer had included in his "System of Medicine"[2] a description which is even

[1] I have used this word in preference to the term "sporadic" which is commonly employed in connection with diseases supposed to be of spontaneous origin, or at any rate is applied to those which it is presumed arise from accidental causes, independently of any contagious influence.

[2] This systematic work on medicine is written in Sanscrit, by D'hanvantare, and compiled by his pupil, Susruta. A Latin translation, by F. Hessler, was published at

more suggestive of diphtheria. The writer mentions a disease in which "an increase of phlegm and blood causes a swelling in the throat, characterized by panting and pain, destroying the vital organs, and incurable."[1] He also says, "a large swelling in the throat, impeding food and drink, and marked by violent feverish symptoms, obstructing the passage of the breath, arising from phlegm combined with blood, is called 'closing of the throat.'"[2] With these passages it may be well to contrast the description given by Aretæus of the Syriac ulcer, a malady which is generally considered to have more points of resemblance to the diphtheria of to-day than any other disease of antiquity. Describing ulcers on the tonsils,[3] Aretæus tells us that some are mild and harmless, while others are pestilential and fatal. The former—which are common—are clean, small, and superficial, and are unaccompanied either by pain or inflammation. The latter—which are rare—are extensive, deep, putrid, and covered with white, livid, or blackish concretion. Aretæus then goes on to describe the way in which, in fatal cases, the disease progresses, stating that "if it extends rapidly to the chest through the windpipe, the patient dies on the same day by suffocation." No more definite description of any disease which we can identify with diphtheria has been given, either by the contemporaries or the successors of Aretæus, and we must pass over many centuries before we come upon any authentic record of the prevalence of such a disease.

It is not until we arrive at comparatively modern times that we find diphtheria forcing itself upon the attention of physicians as a distinct disease. Baillou, a distinguished French physician, who flourished in the last quarter of the sixteenth century, was the first to publish an accurate description. It is in his writings that we find the first definite mention of a false membrane.[4] A few years later, the same appearance was noted by several Spanish physicians as occurring in the course of an epidemic disease, which they minutely portrayed under the name of "garrotillo." The best description is that of Villa Real (1611), who states that he has seen a thousand times (millies vidi) in patients, at the first onset of the disease, a white matter in the fauces, gullet, and throat. He adds that this matter is of such nature that if you stretch it with your hands it appears elastic, and has properties like those of wet leather—facts which he noticed, not only by observing the matter coughed up by the living, but also by the examination of it in the dead.[5] The descriptions of Fontecha[6] (1611) and Herrera[7] (1615) are less satisfactory, as containing no account of post-mortem appearances; but they are valuable in so far as they con-

Erlangen in 1844, and is in the British Museum; it has the following title: Susrutas Ayurvédas; id est Medicinæ Systema a Venerabili D'hanvantare Demonstratum a S. Discipulo Compositum. It is from this translation that the quotations in the text are taken.

[1] Ibid. p. 202.

[2] Ibid. p. 205. The following passage may also possibly describe diphtheria:—"Si quis valde lugens semper suspirat, interruptam vocem, et aridum solutumque sonum habet in respirationis viis, phlegmate oblitis, hic morbus propter suspirium vocis occisor cognoscendus est."—Ibid. 206.

[3] Aretæus: De Causis et Signis Acutorum Morborum, lib. i. cap. 9.

[4] Gulielmi Ballouii: Epidemiorum et Ephemeridum, libri ii., Parisiis, 1640, p. 201.—"Pituita lenta contumax quæ instar membranæ cujusdam arteriæ asperæ erat obtenta."

[5] Johannis de Villa Real: De Signis, Causis, Essentiâ, Prognostico et Curatione Morbi Suffocantis. Compluti, 1611, p. 35 et seq.

[6] Disputationes Medicæ, etc., opus Doctoris Fontecha, Compluti, 1611.

[7] De Essentiâ, Causis, Notis, Præsagio, Curatione et Præcautione Morbi Suffocantis Garrotillo Hispane Appellati, auctore Doctore Herrera, Matriti, 1615.

firm the fact of the prevalence of garrotillo in Spain between the years 1581 and 1611. Some years subsequently to the latter date diphtheria appears to have prevailed as a fatal epidemic in Naples and other parts of Italy. Sgambatus [1] tells us that in 1617 a highly contagious affection of the throat appeared, attacking the children of rich and poor alike, and often sweeping away whole families. The same epidemic is described by Nola [2] and Carnevale,[3] the latter of whom asserts that it was identical with that which had been prevailing in Spain, under the popular name of "garrotillo." The writings of Cortesius [4] (1625) render it nearly certain that the same disease extended somewhat later to Sicily. A membrane in the throat, which could be readily torn away, is distinctly described as being one of its symptoms. The works of Alaymus [5] (1632) and of Aëtius Cletius [6] (1636) have also been quoted as affording corroboratory evidence of the prevalence of diphtheria in Italy and Sicily during the seventeenth century. Medical literature is then silent on the subject for nearly a century, but after that time follows a rapid series of observations from different parts of Europe. In 1713 Dr. Patrick Blair,[7] in a letter to Dr. Mead, described a disease as "the croops," which he says "was epidemic and universal" at Coupar Angus, and which was no doubt diphtheria. In 1748 Ghisi [8] observed an epidemic of the disease in Palermo; in 1749 Marteau de Grandvilliers [9] described a similar outbreak in Paris; in 1750 the formation of a membraniform concretion in the throat is distinctly described by Dr. John Starr,[10] as occurring in an epidemic in Cornwall, and in 1757 a similar observation was made by Wilcke [11] in Sweden. In the same year, Dr. Huxham [12] described an epidemic which had been prevalent at Plymouth, in which some of the cases were examples of scarlatina anginosa, whilst others were undoubtedly cases of secondary diphtheria.

At length the attention of the profession was fully called to the peculiar characters of diphtheria by Dr. Francis Home,[13] of Edinburgh, who, in 1765, under the name of croup described an acute affection of the larynx and trachea, coming on insidiously, attended with the formation of a membrane in the pharynx and air-passages, and often causing death

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[1] De Pestilente Faucium Affectu, Neapoli Sæviente Opusculum, auctore Andrea Sgambato, Neapoli, 1620.

[2] De Epidemico Phlegmone Anginoso Grassante Neapoli, Franciscus Nola, Venetiis, 1620.

[3] De Epidemico Strangulatorio Affectu in Neapolitam urbem Grassanti et per regna Neapolis et Siciliæ Vagante, auctor Jo Baptista Carnevale, Neapoli, 1620.

[4] Johannis Baptistæ Cortesii: Miscellaneorum Medicinæ Decades Denae, Messanae, 1625.

[5] Marci Antonii Alaymi: Consultatio pro Ulceris Syriaci nunc Vagantis Curatione, Panhormi, 1632.

[6] De Morbo Strangulatorio, opus Aëtii Cletii Siguini, Roma, 1636.

[7] Observations in the Practice of Physic, etc., London, 1718.

[8] Lettere Mediche del Dottore Martino Ghisi, Cremona, 1749.

[9] Dissertation Historique sur l'espèce de Mal de Gorge Gangréneux qui a regné parmi les Enfants l'année dernière, Paris, 1749.

[10] Philosophical Transactions, 1752, vol. xlvi. p. 435.

[11] Dissertatio Medica de Anginâ Infantum in Patriâ Recentioribus annis Observatâ, Wilcke, Upsalæ, 1764.

[12] A Dissertation on the Malignant Ulcerous Sore Throat, 1757, though generally quoted by writers on diphtheria, is not referred to above, as it really deals with scarlatina anginosa.

[13] An Inquiry into the Nature, Cause, and Cure of Croup, by Francis Home, M.D., Edinburgh, 1765.

by suffocation. Home appears to have been the first to notice the quick, weak pulse which is so characteristic of the disease. The treatise of the Scotch physician attracted the attention of Dr. Michaelis,[1] of Göttingen, who, in an essay published in 1778, confirms and supplements his observations. From time to time epidemics of scarlatina were described in which the throat symptoms predominated, and some of these have been wrongly supposed to have been examples of diphtheria.[2] The next record of the disease comes from America, where in 1789 Dr. Samuel Bard,[3] of Philadelphia, published a minute account of "an uncommon and highly dangerous distemper" which had recently proved fatal to many children in New York. Dr. Bard was a careful and painstaking observer, and his monograph contributed very considerably to the accuracy of contemporary knowledge with regard to diphtheria. In 1798[4] another American physician, Dr. John Archer, published an interesting paper, and recommended a new remedy for the disease. In the year 1801 Dr. Cheyne,[5] a British physician, published an essay in which he distinctly portrays diphtheria under the name of cynanche trachealis or croup. He recognizes it as the same disease as that referred to by Ballou, Ghisi, Home, and Michaelis, and gives a minute description and plates of the false membrane found in the trachea after death. In 1802 Dr. Cullen,[6] the well-known professor of the practice of physic in the University of Edinburgh, gave a description of cynanche trachealis, in which we cannot fail to recognize the diphtheria of modern times. For many years after its appearance Dr. Cullen's work was the favorite text-book on medicine with all British practitioners and students, and its author, therefore, may claim the credit of having rescued diphtheria from the region of discussion and monographs, and of having given it a fixed and recognized position in medical science. The disease, however, was evidently still a rarity in the British Isles, and it probably only occurred in the isolated form. In France the case was otherwise: the disease was well known as a frequent visitor, under the name of croup, and having caused the death of some of the members of the Imperial family in 1807, a prize was offered by Napoleon I. for the best essay on the subject. This led to the publication of the valuable works of Albers, Jurine, and Royer-Collard—works which were worthy predecessors of the classical memoirs of Bretonneau.[7] The latter owed their origin to an alarming outbreak of the disease at Tours in the latter part of the year 1818. The epidemic was most carefully investigated by Bretonneau, who published an account of his researches in 1826. An accurate description of "diphthérite" was given by Dr. Abercrombie in a work published in 1828.[8] The disease appears to have prevailed in an epidemic form in Edinburgh in the year 1826, but otherwise it was by

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[1] De Angina Polyposâ sive Membranaceâ, Göttingen, 1778.

[2] An Account of the Sore Throat attended with Ulcers, by Dr. John Fothergill, London: Fifth edition, 1769.

[3] Transactions of the American Philosophical Society, Philadelphia, 1789.

[4] An Inaugural Dissertation on Cynanche Trachealis, commonly called Croup or Hives, Philadelphia, 1798.

[5] Essays on the Diseases of Children, with Cases and Dissections, by John Cheyne, M.D., Edinburgh, 1801.

[6] First Lines of the Practice of Physic, by William Cullen, M.D., Edinburgh, 1802, vol. i., p. 219.

[7] Des Inflammations Spéciales du Tissu Muqueux et en particulier de la Diphthérite, Paris, 1826.

[8] Pathological and Practical Researches on the Diseases of the Stomach, etc., by John Abercrombie, M.D., Edinburgh, 1828.

no means a common affection in this country. In fact, after the brief notoriety conferred on diphtheria by the works of Bretonneau, the disease seems to have passed from the minds of English physicians, and its very existence to have been almost forgotten. It still occurred from time to time in all parts of Europe, but it did not excite attention to any great extent until the year 1853, when it broke out with some violence in Paris. In 1855 an epidemic at Boulogne, which was especially fatal to the resident English, excited considerable attention, and during the two following years serious outbreaks were reported from different parts of France. The first case of the greatest epidemic of the disease which, as far as is known, has ever occurred in this country, was imported from Boulogne to Folkestone in 1856,[1] but it was not till 1858 that the disease attained very alarming proportions in this country. Spreading, as it seemed, from many independent centres, it raged as a widespread and fatal epidemic during 1859, and continued very seriously prevalent during the three following years.[2] Since that time diphtheria has not appeared in England with anything like the same malignancy; it still claims several thousand victims annually, but its invasions are for the most part circumscribed in area, and both in this country, and on the Continent, only expand from time to time into limited epidemics.

Etiology.—The *exciting* cause is a specific contagium, and those cases which appear to originate *de novo*, probably always arise from the virus —often long dormant and forgotten—of previous cases. Tender age is the principal *predisposing* cause, but the accidental existence of pharyngeal catarrh, or of any disease which lowers the system, probably increases individual receptivity. Family constitution also often exercises an unfavorable influence.

The natural history of the contagium has not yet been elucidated. Some information has been obtained as to the atmospheric conditions and temperature under which the poison exists and flourishes, but considerable uncertainty exists as to the laws which govern its development and effect its diffusion. The mode or modes also in which the disease producing virus enters the system, and its period of incubation, have not yet been accurately determined. These various points will now be considered in detail.

The Natural History of the Contagium.—The contagious principle has not been isolated, although it is highly probable that it consists of minute particles of matter, which are capable of floating in the atmosphere, and attaching themselves to rough surfaces (*see* Mode of Diffusion). The doctrine has been put forth by Oertel, Hueter, Nassiloff, and Letzerich, that a minute fungus is the essential contagium. The views of these authors will be referred to in detail in treating of the pathology, and it is sufficient to state here that the observations are not sufficiently conclusive to warrant us in considering that the essence of the disease has yet been discovered. Low vegetable organisms probably play an important part in the propagation of the disease, but the exact relation between the disease and the organisms has not as yet been made out. The experiments of Oertel, Letzerich, and others, if uncontradicted, would only

[1] Reports of the Medical Officer of the Privy Council, No. ii., London, 1860.

[2] The best accounts of the epidemics of that period are those of Mr. Ernest Hart: Diphtheria, London, 1859, and Mr. Netten Radcliffe: The Recent Epidemic of Diphtheria, Trans. of the Epidem. Soc., February, 1862.

show that micrococci are an invariable concomitant of diphtheria; that they are the sole or even the main agent in its causation cannot as yet be considered proved. Dr. Maclagan[1] has, however, clearly shown that "the germ theory" explains all the phenomena of the specific fevers, and in a matter, which at present is beyond *inductive* proof, analogy is of the highest value. For a further consideration of this subject, the reader is referred to the section on Pathology.

In considering the etiology of the disease, it is most important to determine whether it can originate *de novo* or not. Although the disease so often arises in connection with bad drainage, foul habits, and impure water supply; and although it is so often impossible to trace the remotest channel of contagion, yet the whole tendency of sanitary science is opposed to the doctrine of the spontaneous origin of specific diseases.[2] It must not be forgotten that in those cases where the disease appears to enter the system through the use of drinking water contaminated with excrementitious matter, the specific germs of the disease, derived from persons previously suffering from it, may have found their way into the water. I have frequently known the disease occur suddenly in remote country districts, where careful inquiries have failed to discover the smallest evidence of infection, but similar phenomena are often observed in connection with scarlatina and small-pox—diseases which no one would now attribute to a spontaneous origin.[3] A very remarkable instance of the apparently spontaneous origin of the disease was observed last year by Dr. Semon, at a small health resort, called "Bad Fusch" in the Tyrol. The place, consisting of only two houses, is situated at an elevation of from 3,000 to 4,000 feet above the sea, and is celebrated for its fresh air and pure water. In one of these houses a little girl, five years of age, who had left Vienna five weeks previously, was suddenly attacked with diphtheria, which was subsequently followed by paralysis. The visitors consisted almost entirely of tourists, ascending the high mountains in the neighborhood. Although other children had been playing with the little girl up to the day on which she was attacked, no other case of this kind occurred. It need scarcely be said that the outbreak of the disease in this case may, however, also be explained in accordance with the theory of contagion.

Climatic and Atmospheric Conditions under which the Contagium Lives and Flourishes.—The disease exists in almost every country, but it is most common in temperate climates. The contagium lives under ordinary atmospheric conditions, but it is probable that dampness favors its development. It occurs in the tropics, but does not appear to have been noticed in the Arctic regions. It seems likely that the germs may remain dormant, *external to the body*, for a considerable period, and may only develop under the stimulus of some particular atmospheric conditions,[4] or when a suitable nidus presents itself. In making statistical inquiries, with reference to the registration of disease in sub-districts, Dr. Thursfield[5] found in certain isolated hamlets and houses where in recent

[1] The Germ Theory, etc., London, 1876.

[2] Simon: Sixth Report on Public Health, quoted by Dr. Aitken: The Science and Practice of Medicine. Sixth edition, vol. i. p. 338.

[3] Dr. Kelly also states, as the result of his experience as the sanitary officer of a wide tract of country, that diphtheria often appears in lonely outlying places, far away from any main road; and often no history of contagion can be traced at all.—Second Annual Report of the Combined Sanitary Districts of West Sussex.

[4] Sanné: Traité de la Diphthérie, Paris, 1876, p. 231.

[5] Lancet, vol. ii. 1878, Nos. vi. vii. viii.

years he had been called upon to investigate cases of diphtheria, that at intervals of five, ten, fifteen, twenty-five, thirty, and even more years, there had been previous outbreaks of fatal sore throat. An instance is recorded by Dr. William Squire[1] in which the virus remained latent eleven months, and then led to the development of the disease when a person occupied the room in which a case of diphtheria had previously occurred. I have known the poison to remain dormant for four, seven, and fifteen months, and in one instance for three years, and then again to become active. From the above considerations the vitality of the disease-germs would seem to be considerable.

In Great Britain the disease has generally been prevalent in those parts of the country where the rainfall is great, in villages situated in valleys, or in places where there is not sufficient fall to get rid of the surface drainage, but it has also been frequently met with, and shown great epidemic persistency, in high, dry, and exposed situations.

The disease is much more common in rural than in urban districts. Whether, however, this fact points to the greater humidity which prevails in the country, or to the absence of proper drainage, is not at present certain. According to Dr. Thursfield,[2] whose experience as a sanitary inspector extends over twelve hundred square miles, "with a population of rather more than two hundred thousand, of which rather more than one hundred thousand are rural, the number of fatal cases of diphtheria in the rural portion is nearly three times that in the urban portion." The same author remarks that whatever conditions seem to promote fungoid growth, would appear to favor the incidence and persistence of the disease, and the explanation of the comparative immunity of towns may be the presence of something in their atmosphere inimical to such growth.

Until recently the extension of the disease was considered to be independent of season, but the observations of Wibmer[3] and Thursfield[4] tend to show that it prevails more extensively during the winter months than at other periods of the year. Many severe epidemics have, however, steadily raged through the whole round of the year in spite of the most varied changes of weather and temperature.

Mode of Diffusion.—Considerable difference of opinion exists as to the mode in which the poison is diffused. The disease may be imparted to others by a person actually, or lately, suffering from it, but the extreme difficulty of effecting *artificial* implantation would tend to show that direct contagion is rare. From this fact it would seem probable that the contagium, when set free from the affected individual, undergoes further development (as in the case of cholera and typhoid fever), which increases its disease-producing properties. It is asserted that the poison may be conveyed by a person not actually affected by the disease. Dr. Thursfield[5] has reported a very remarkable case, in which a woman living in an infected house, but not at any time suffering herself, walked a mile or two and crossed a ferry to visit a friend. She only remained a short time in the house, but sufficiently long to leave the germ of diphtheria, which broke out a day or two afterward. This, however, is such an exceptional example, that the possibility of the malady having arisen from

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[1] Reynolds' System of Medicine, vol. i. p. 379. [2] Loc. cit.

[3] Statistischer Bericht über die Münchener Epidemien, 1864—69, quoted by Oertel: Ziemssen's Cyclopædia, vol. i. p. 590; also Deutsch. Arch. f. kl. Med., 1870, vol. viii. p. 242; Experimentelle Untersuchungen über Diphtheritis, p. 346.

[4] Loc. cit. [5] Loc. cit.

other sources must be borne in mind. In one instance I have known the disease caught from a patient who had entirely recovered from it four months previously, but whether it was conveyed by the person or the clothes of the individual, it was impossible to determine. In solitary cases the contagium does not usually assume a virulent form, and proper measures are almost invariably successful in confining the disease to a limited area. The distance at which the contagious principle can operate as a rule appears to be more limited than is the case in typhus or small-pox. Thus I have known an instance in which seven children were affected in a house which had a residence on each side of it, and a third opposite at a distance of only twenty-four feet. Although in all these buildings there were young children, no other case of diphtheria occurred. Other similar illustrations of this fact are on record.[1] Under certain circumstances, however, the diffusive powers are increased, and, as appears to be the case in epidemics of influenza, the poison may be wafted over extensive tracts of country.

The germs of diphtheria appear to have an affinity for the walls of rooms, and, according to some observers, may attach themselves to clothes and articles of furniture.[2] It is probable that by the introduction of such things the poison is often diffused.

Manner in which Poison enters the System.—The poison may be received into the system (*a*) by direct implantation; (*b*) through the circumambient air; (*c*) through the water that is drunk, or the food that is eaten. Further, it is possible that it may be occasionally introduced by inoculation, either with portions of false membrane or with the blood of a patient suffering from the disease.

(*a*) The melancholy deaths of Valleix and Henri Blache,[3] show that the disease may occasionally originate from direct implantation. M. Sée[4] has reported a case of the same character, in which a woman suckled a child affected with diphtheria. In consequence her own child, which she was nursing at the same time, contracted labial diphtheria, and communicated it to the mother, who frequently kissed her infant. An instance of direct implantation has been placed on record by Professor Bossi,[5] in which a greyhound was seized with symptoms akin to those of diphtheria four days after swallowing the excrement of a child who died of that disease; after death a membranous exudation was found on the animal's fauces.[6]

(*b*) The contagium which exists in the secretions and exhalations of the sick may pass into the air and find its way directly into the healthy organism by absorption through the lungs, or through the mucous membrane of the throat; or the secretions of the sick may pass into drains, and sewer-gas, holding the disease germs in suspension, may be afterward inspired.

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[1] Thursfield: Loc. cit.

[2] Sanné: Op. cit.

[3] Trousseau: Clin. Lectures, New Syd. Soc. Trans., vol. ii. p. 497.

[4] Bull. de la Soc. Méd. des Hôp., t. iv. p. 378.

[5] Sir J. R. Cormack: Clinical Studies, vol. ii. p. 273; Lo Sperimentale, 1872, p. 230.

[6] Dr. Sanderson has placed on record a somewhat analogous illustration: Three sows, which had access to a piece of waste ground on which "the discharges or concretions" of some patients suffering from diphtheria were thrown, quickly died with symptoms of suffocation, enlarged submaxillary glands, and in one case with diphtheritic membrane in the fauces.—Reports of the Medical Officer to the Privy Council, London, 1860.

(*c*) The poison may be conveyed through food or water (or other fluid used for drinking purposes), as in the analogous case of typhoid fever. Here it may be mentioned that Bossi's case, referred to above, may be an example of the manner in which the poison is absorbed through the alimentary canal—not an example of direct implantation. In many of the cases of diphtheria which I have seen during the last few years, the drinking water was found to be contaminated with excrementitious matter.

As regards direct *inoculation with diphtheritic membrane*, the experiments made with false membrane, by Trousseau,[1] Peter, and Duchamp,[2] upon themselves, and by Dr. G. Harley [3] upon animals, gave only negative results. In the experiments of Trendelenburg [4] and Oertel,[5] on rabbits, a diphtheritic membrane formed in the trachea, as the result of direct irritation of that part with diphtheritic matter, and the animals died on the second or third day, with acute kidney disease, and symptoms of general infection. Nassiloff [6] and Eberth [7] have produced diphtheritic keratitis by direct inoculation, while Hueter and Tommasi [8] and Oertel, in their experiments on the muscles, found that soon after inoculation a diphtheritic layer appeared round the edges of the wound; hemorrhagic inflammation was induced in the muscles, and the animals died on the second day from general blood-poisoning. Although in some of these experiments a false membrane was produced, the septicæmia may have been merely the result of inoculation with decomposing animal matter, and it cannot be considered that true diphtheria with its specific manifestations has yet been artificially produced by inoculation of the lower animals, though certain local phenomena of great interest and importance have been induced.

A few cases are on record in which medical practitioners are said to have been *inoculated with blood, i. e.*, to have become infected through the accidental prick of a lancet smeared with the blood of a patient suffering from diphtheria, but as it is extremely difficult to inoculate successfully with blood in other diseases of much higher contagious power, it is highly improbable that diphtheria can originate in this way.[9] Moreover, it must not be forgotten that in the cases referred to the medical men attacked were exposed to the general influence of the contagion.

Period of Incubation.—The period of incubation is exceedingly short—generally two or three days—but on the other hand the germs of the disease may remain about the person subsequently attacked for some weeks before the complaint makes its appearance. In illustration of the first-named fact, the following case, which came under my own observation, may be cited. A girl, aged six, who had been absent from home for five weeks, returned one afternoon at four o'clock. Her young brother, aged four, had shown symptoms of sore throat the same morning, but no suspicion was entertained that the disease was diphtheritic. These two children remained together till bedtime, but did not sleep in the same room. The next morning both of them had marked diphtheria, with an abundance of false membrane. The little girl had not been subjected to any infection before reaching her home. On the other hand, I have

[1] Reports of the Medical Officer to the Privy Council, London, 1860, p. 335.
[2] Du rôle des parasites dans la diphthérie : Thèse de Paris.
[3] Pathological Transactions, vol. x. p. 315.
[4] Arch. für Klin. Chirurgie, 1869, x. 2.
[5] Loc. cit.
[6] Virchow's Archiv, 1870, p. 550.
[7] Correspondenzblatt, 1872.
[8] Centralblatt f. Med. Wissenschaften, 1868, p. 34.
[9] Dr. Klein : Experimental Contribution to the Etiology of Infectious Diseases : Quarterly Journal of Microscop. Sc., vol. xviii. p. 169 et seq.

known one instance in which the disease occurred fifteen days after exposure to contagion: A young lady, aged eighteen, insisted, contrary to the advice of her friends, in paying a visit to her cousins living in London, who were convalescent from diphtheria. She spent about two hours in their society, and then returned to her home in the country. Fifteen days after her visit she was attacked with diphtheria.

Predisponents.—The most obvious predisposing cause is *age*. From an analysis[1] of nearly 70,000 fatal cases contained in the returns of the Registrar-General, it appears that in every thousand fatal cases the age at death is as follows:—

Under 1 year	90
From 1 to 5 years	450
" 5 to 10 "	260
" 10 to 15 "	90
" 15 to 25 "	50
" 25 to 45 "	35
" 45 years and upward	25

Again, in the Florentine epidemic,[2] out of 1,546 cases occurring in the years 1872 and 1873, in only fifteen were the patients over thirty years of age. These figures are markedly different from any which could be compiled of other zymotic diseases. *Sex* does not influence the incidence of the disease to any appreciable extent; for, although, according to the Registrar-General's returns, the mortality of females from diphtheria is rather higher than that of males, the reverse applies to "croup," a term under which a very large proportion of the cases of diphtheria are returned. Next in importance to age as a predisposing cause would seem to come *family susceptibility*.[3] The liability of diphtheria to attack the members of certain families is well proved. Sir William Jenner[4] lays great stress upon family constitution as being "one of the most important elements favoring the development of the disease and determining its progress." He quotes one case in which five members of a family took the disease, two in which four, and eight in which two were affected. In the Florentine epidemic, in four cases diphtheria proved fatal to three members, and in twenty-two cases to two members of the same family. Some remarkable instances of family susceptibility have come under my own notice. In one case a poor woman had three children of her own, and took care of two others in no way related to herself; her own children were attacked by the disease, and one of them died. The other two children—not her own, who were constantly in the same room with the little patients, never suffered from the disease. In another case four

[1] Thursfield: Loc. cit.

[2] Dr. Borgiotti, Capo medico del Uffizo d'Igiene e Beneficenza, in the Rendiconto amministrativo della Giunta al Consiglio Communale di Forenze, collected a series of the most valuable statistics on the Florentine epidemic of 1871–73, but unfortunately they are buried in the Municipal Archives. I am indebted to Dr. Wilson, of Florence, for most kindly copying Borgiotti's figures from the source referred to. Dr. Borgiotti's views are, however, given with considerable detail in the Atti dell' Accademia, Medico-fisica Fiorentina, 1871-72-73.

[3] Two very painful examples of intense family susceptibility have been recently reported; in one case eight, and in another case six children in one family were cut off by the disease within a few days. See Lancet, 1877, vol. i. p. 919, and Return of the Registrar-General of Ireland for the last Quarter of 1876.

[4] Diphtheria, its Symptoms and Treatment, London, 1861, p. 51.

families occupied a house near Woodford, in Essex. In all of them there were several children. Two of the families were related, the mothers being sisters. All the children who were related to each other had diphtheria severely, whilst the children of the other two families escaped entirely. During the progress of the disease no attempt at isolation was made, the healthy children frequently entering the rooms of the patients.

Social position is not without influence on the distribution of the disease. In its endemic form it rarely attacks those who live in healthy and well-ventilated houses. But where it is epidemic, it manifests no respect for social rank or wealthy surroundings. Under these circumstances, as Dr. Greenhow remarks, "station of life and the enjoyment of affluence, or exposure to the privations of poverty seem to have but small influence either in predisposing persons to take or to suffer severely from the disease."[1] The statistics of Dr. Borgiotti[2] tend to show that *during an epidemic* of diphtheria no importance is to be attached to the hygienic condition of a locality as a cause of the malady. In the Florentine epidemic many persons fell victims who lived in lofty, well-ventilated, and, in all respects, salubrious habitations. It must not be forgotten, moreover, that when diphtheria becomes epidemic in a town, an elaborate system of drainage is calculated to convey the poison by means of the sewers, and that water-closets afford a ready means of contaminating cisterns and introducing sewage gas into residences. Hence, the wealthy are sometimes subjected to causes of infection which the poorest may escape.

When an epidemic exists, the accidental occurrence of a catarrh often seems to attract the specific virus to the throat.

Certain acute diseases, as well as those of a chronic character accompanied with great debility, predispose to the disease, and when it attacks persons who have been previously suffering from some other affection it is called *secondary diphtheria*.[3] It is most apt to occur in measles and malignant scarlet fever, but it is met with in certain epidemics of small-pox, typhoid fever, and whooping-cough. It also, by no means unfrequently, attacks patients in the last stage of phthisis. The disease does not differ essentially in its character, whether it is primary or secondary, but it is thought by some physicians to be less contagious under the latter circumstances, and it attacks adults in relatively larger numbers.

Much still remains to be explained with regard to the etiology of diphtheria. No satisfactory theory has yet been offered as to the reason why in certain years the disease should spring up in epidemic form and resist all our attempts to arrest it, while at other times it arises, perhaps, in some remote hamlet, without any traceable antecedent, and, after flickering for a time, dies away as suddenly as it appeared.

Protective Influence of an Attack of Diphtheria.—As in the cases of typhoid fever and cholera, an attack of the disease probably affords a protection—though a very slight one—against recurrence. In estimating the protective power exercised by an attack of diphtheria, it must not be forgotten that even in diseases such as small-pox and scarlatina, where previous attacks afford great subsequent immunity, recurrence does sometimes take place, and that there are many well-established cases on record of these affections occurring more than once in the same individual. The fact that diphtheria recurs, in some rare instances, does not, therefore, by

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[1] On Diphtheria, London, 1860, p. 134. [2] Loc. cit.

[3] A description of the disease as a secondary phenomenon will be found in the succeeding articles.

any means disprove its protective influence in the majority of cases. I have myself known three instances in which children have died from the second attack. In two of these, the first attack (occurring a year previously in one case, and seven months in the other) was seen by another practitioner; but, from the circumstances of there having been slight paralysis in each instance, I have no doubt as regards the diagnosis. In my own case, I saw a child aged four with pharyngeal diphtheria, in May, 1874, who died of laryngeal diphtheria under my care in July, 1875. I have seen the disease occur, in a mild form, three times in the same individual, at intervals of five months, a year, and two years.

Symptoms.—The symptoms of diphtheria vary in different cases from those of quite a slight sore throat to those of the most serious and malignant blood-poisoning. Between these two extremes we meet with every gradation of intensity. The presence of "false membrane" in the throat is the characteristic symptom, but sometimes, in slight cases, the disease passes off without the formation of any membranous exudation, and occasionally the patient dies before it is developed. Again, the local affection is, in some cases, accompanied with considerable inflammation, whilst in others there is scarcely any hyperæmia. Hence it is convenient, in describing the symptoms, to classify the varieties of the disease. The following are the different constitutional forms: (1) *The typical form;* (2) *the mild, or catarrhal form;* (3) *the inflammatory form;* (4) *the malignant form;* (5) *the gangrenous form;* (6) *the chronic form.* An attempt has been made to establish another variety—the insidious form; but whilst one author[1] finds its expression in the sudden development of laryngeal symptoms, another[2] considers that the patient either dies "from the progress of marasmus," "or suddenly from an effort," or quickly succumbs to one of the unfavorable complications which supervene. It will be seen, therefore, that the insidious character cannot be regarded as constituting a special form of the disease.

The student must not expect to find the first three forms always clearly defined; on the contrary, they are apt to run into one another, or their special features may be more or less combined. The differences dependent on site are—(*a*), *nasal diphtheria;* and (*b*), *laryngeal diphtheria* or *croup.* It would be foreign to the scope of this work to enter into the subject of cutaneous diphtheria, or to consider the local manifestations of the affection, when it attacks any of the various organs whose mucous covering is susceptible to the poison.

The course of (1) *typical diphtheria* is somewhat as follows: After a period of incubation varying from two to five days, during which the patient suffers from general *malaise* and depression, with occasional chilliness, the disease announces itself by a definite constitutional disturbance.

The *first stage* commences with a rapid rise in the temperature and pulse-rate—the former often reaching 103° and occasionally 104° F. within a few hours—an increased feeling of chilliness, loss of appetite, nausea, and in some instances vomiting or diarrhœa. If the patient is an adult he complains of pain in the loins, of headache, and often of giddiness. His attention is, however, soon diverted from these general symptoms to his throat, which in a very short time begins to feel hot and dry, and to cause pain in swallowing, whilst the neck feels stiff, swollen, and tender. In a child these subjective symptoms are to a great extent lost.

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[1] Jenner: Loc. cit. p. 20.

[2] Sanné: Loc. cit. p. 123.

The physician, called to a case such as is here described, will at once proceed to inspect the patient's throat, and will probably find the tonsils, the pillars of the fauces, the uvula, and the back of the pharynx red. swollen, and turgid. But the false membranes which are characteristic of the disease will very possibly have not yet made their appearance. If they have not, a few hours will probably suffice to develop them.

The *second stage* will then be present. On carefully watching the progress of the case a viscid yellowish secretion will be seen gradually accumulating in the depressions on one or both tonsils; a little later the superficial layers of mucous membrane become infiltrated at certain points with a yellow substance, which raises them above the level of the surrounding normal tissue. The infiltrated patches, which are at first more or less translucent, soon become opaque, at the same time changing in color from yellow to a grayish white, extending at their periphery, and coalescing with similar adjacent patches. In this way a considerable surface of the fauces and pharynx becomes coated with false membrane, which, being constantly reinforced by additions to its under surface, gradually assumes a leathery consistence and a lardaceous appearance. Strips of this membrane may now be torn off, and in some cases with care the whole of it may be removed in the form of a cast of the parts on which it is deposited. The mucous membrane beneath will be found robbed of its epithelium, of a vivid red color, and covered with numerous hemorrhagic points. Externally the neck is more or less swollen and brawny, whilst the parotid, submaxillary, and lymphatic glands are frequently enlarged, hard, and tender.

The temperature in most cases gradually subsides as the exudation extends, but sometimes it remains at a high point, and may even increase as the local process develops. According to Faralli,[1] however, who made a series of careful observations on the temperature in sixty cases of diphtheria in the Florentine epidemic, it usually falls to normal by the fourth or fifth day, though in moderately severe cases it again shows a tendency to rise after that date.

The patient still complains of difficulty in deglutition, and suffers from a constant "hawking," caused by his endeavors to get rid of the tenacious secretion which is poured out from the mucous membrane. Unless the mouth is repeatedly washed out with a disinfectant gargle the breath becomes horribly offensive, from the decomposition of the morbid secretions in the throat. The *primary* blood-poisoning is shown by the extreme debility, the pulse being weak and compressible, and often either exceptionally rapid or exceptionally slow, while the first sound of the heart is muffled, and devoid of tone; and by the albuminuria, which is an almost constant symptom in this class of cases, and appears at a very early period of the disease. The urine itself is scanty and high-colored, containing an excess of urea, and numerous hyaline, granular, and epithelial casts.

It is at this period that the diphtheritic process, instead of limiting itself to the pharynx, may spread in a downward direction, and attack the larynx and trachea, thus exposing the patient to the serious risk of death from asphyxia. This extension, when it occurs, usually takes place within three or four days of the invasion of the disease, and is in most cases announced by unmistakable signs. The voice becomes hoarse and muffled, the breathing is more or less stridulous, and there is a constant dry

[1] Sul ciclo termico della difterite : Imparziale, Marzo, 1873.

and toneless cough. To these symptoms succeed those of embarrassed respiration, viz., distressing dyspnœa, gradually increasing cyanosis, swelling of the face, and drowsiness, passing into fatal coma. We have, in fact, a case of laryngeal diphtheria or true croup—one of the most fatal diseases to which humanity is liable. This important subject will be found treated in detail further on.

The other extensions are less important, but are of unfavorable signification. The implication of the nasal cavity generally announces itself by the discharge of a fetid, dark-colored watery fluid, which excoriates the margins of the nostrils. This condition may remain until the patient recovers or dies, or it may be followed by the formation of false membrane on the lining membrane of the nose, and the discharge of fibrinous lumps through the anterior, or posterior, nares. It is sometimes accompanied by repeated and perhaps fatal epistaxis. Sometimes there is blocking up of the lachrymal duct, and consequent overflow of tears. Cases, indeed, occasionally occur in which the diphtheritic process extends by this route to the conjunctiva, and a plastic exudation takes place on that membrane. If the inflammation passes along the Eustachian tube, complaint will be made of roaring noises in the ears, of darting pains, and of deafness, which may be followed by perforation of the membrana tympani, and the discharge of a purulent fluid.

Supposing that the disease has not attacked the larynx the *third stage* now sets in, and the disease pursues one of two courses: it may subside, and the patient may slowly recover; or it may quickly end fatally.

If the disease terminates favorably a marked improvement in all the symptoms takes place generally at the end of the first or at the beginning of the second week. The swelling and injection of the mucous membrane steadily subside, the exudation ceases to extend, and portions become successively loosened and are thrown off. All the local discomfort rapidly disappears, and the general symptoms improve. The temperature and pulse-rate fall to normal and remain so, the appetite returns, the urine becomes of natural color and quality, the skin resumes its functions, and with the exception of a certain degree of muscular weakness the patient feels quite well. He is not, however, as yet quite out of danger; it is not at all an unfrequent event for a relapse to occur, with a fresh formation of false membrane, and a return of all the most serious symptoms; or the heart's action may show signs of failure, and he may die of syncope. Even if he escape these contingencies, he may at a later period experience the discomforts of diphtheritic paralysis.

If the disease, instead of yielding, takes an unfavorable turn, the patient may either sink from *secondary* blood-poisoning, with typhoid symptoms, or coma may precede death; more often, however, death occurs from cardiac embolism or simple syncope.

(2.) In *mild or catarrhal diphtheria* the symptoms are often so slight that the practitioner hesitates to attribute them to a disease, the very name of which is heard with consternation. Indeed it is, as a rule, only when his attention is aroused by the proximity of other undoubted cases, that he is at all likely to recognize the disease in its earlier stages. The symptoms are simply those of an ordinary catarrhal sore throat. The diphtheria, in fact, has been arrested at the first stage of its development. The constitutional disturbance is very slight; the temperature rises a degree or two above the normal, and the pulse is quickened in proportion. There is slight pain, and a feeling of dryness in the throat, and as a

rule some degree of difficulty in swallowing. The submaxillary and cervical glands are not unfrequently swollen and tender. On inspecting the patient's fauces, no characteristic exudation is seen. The tonsils, soft palate, and back of the pharynx are of a bright red color, and somewhat swollen. In many cases the redness and swelling are limited to one side of the throat, the opposite side presenting an appearance of perfect health. At first the throat is dry, and there is a marked diminution in the quantity of the natural secretion; but this stage soon passes, and then minute accumulations of yellowish matter, not much exceeding the size of a pin's head, may be seen adhering to the surface of the tonsils, or to the posterior wall of the pharynx. These may be readily removed with a camel's-hair brush. As a rule the patients quickly recover, and by the third or fourth day may be declared convalescent. They often, however, suffer from a considerable degree of prostration during the illness, and a sense of weakness may remain for some days or weeks after the disappearance of the local affection. The symptoms above sketched are sometimes associated with a trace of albumen in the urine, but occasionally the first evidence of the true nature of the throat affection is the occurrence of the characteristic paralysis. The appearance of one or other of these symptoms often forms the only clue which the physician has to the nature of the primary affection, which in all other respects closely resembled a simple sore throat. In some instances, however, the catarrhal affection serves only to introduce the more serious form of the disease. In such cases, after the more trivial symptoms have lasted for three or four days, there is a sudden accession of fever, with marked constitutional disturbance and increase in the local symptoms. Exudation forms rapidly in the throat, and with it the disease assumes all the characters which have already been described under "typical diphtheria."

(3.) The *inflammatory form of diphtheria* is characterized by the active hyperæmia which precedes, and accompanies, the exudation of lymph. On examining the throat, the appearance is that of acute pharyngitis, the mucous membrane of the uvula and fauces being greatly inflamed. Within twenty-four hours a thick false membrane usually covers the inflamed parts, but I have met with one case in which the exudation did not take place till four days after severe inflammation commenced. The tonsils are often increased in size, and the glands at the angle of the jaw are generally enlarged and tender. There is severe odynphagia. The pulse is very frequent, and the patient has a hot, dry skin, and often complains of great thirst. It is in this form of diphtheria, as Sir William Jenner[1] has pointed out, that the joints sometimes become swollen and inflamed.

(4.) In *malignant diphtheria* the attack begins with severe rigors, headache, and vomiting, and there is often also bleeding of the nose. The patient is at once, as it were, knocked down by the virulence of the disease. Throat-symptoms are not generally severe, but the secretions rapidly undergo decomposition, and cause the breath to have a most intolerable fetor. The temperature is not high, but the pulse is rapid, small, and irregular. Restless at first, the patient soon becomes apathetic and drowsy; his face grows pale, and his skin cold and clammy. The tongue is brown, dry, and tremulous, and sordes form upon the teeth. Hemorrhages may occur from the various mucous surfaces, and petechiæ often appear beneath the skin. In short, all the symptoms of the typhoid

[1] Loc. cit. pp. 17, 18.

state appear, and the patient finally becomes delirious and dies comatose, or succumbs to an attack of syncope.

(5.) *Gangrenous diphtheria* is very rare in this country, except as a secondary phenomenon following scarlet fever. The process generally supervenes very rapidly after the formation of the false membrane, and the symptoms are such as have been described under putrid sore throat (page 30). These cases always terminate fatally.

(6.) *Chronic diphtheria* is a more rare disease. In the years 1863 and 1864 eleven patients (seven men and four women) came under my care in whose cases there was false membrane in the pharynx. In three of them at the same time there was deposit in the larynx. The patients were all able to attend as out-patients at the hospital, and though in several cases they were weak, yet they showed no very great degree of debility. In four instances there was albuminuria: in two of these it was intermittent and in two constant. The longest duration of any of these cases was three months, the shortest seven weeks, the average being nine weeks. In all the cases, when the false membrane was mechanically removed, bleeding occurred, and a fresh formation quickly took place. Various local treatment was adopted, but without any decided success. The power of maintaining the false membrane seemed to be lost after a time, and the lymph was at last separated without reproduction. Barthez[1] has also described a case where the false membrane lasted for several weeks, and showed a highly persistent power of reproduction, and Isambert[2] mentions an instance in which a student became affected with nasal diphtheria, and continued for several months to expel pieces of false membrane on blowing his nose.

Some of the symptoms of diphtheria demand a more detailed discussion than has been accorded them above.

The occurrence of *albuminuria* in cases of diphtheria was discovered by Dr. W. F. Wade,[3] of Birmingham, in the year 1857, and some months later it was independently observed by Dr. Germain Sée, of Paris.[4] In the greater number of cases of diphtheria the urine is found to be albuminous at some period of the disease. The albumen usually makes its appearance within the first few days, and sometimes within the first twenty-four hours of the invasion,[5] but it may be delayed until as late as the third week. Its presence is rarely constant in any case. It may fluctuate considerably in quantity from day to day and from hour to hour, and it may disappear and reappear more than once before recovery sets in. The severity of the case furnishes us with no indication as to the probable occurrence of albuminuria; it has been searched for in vain in some most malignant cases, and it has been detected in the course of very mild attacks. It is never associated with any tangible amount of hæmaturia, but the urinary deposit usually contains hyaline, granular, and epithelial casts of the renal tubules. The urine itself is generally more or less highly colored, and of high specific gravity, and it contains a considerable excess of urea, as is the case in most other diseases of a pyrexial character. The albuminuria of diphtheria is almost always a transient phenom-

[1] Bull. de la Soc. Méd. des Hôp., 1858.
[2] Lorain et Lépine: Nouveau Dict., 1869.
[3] Midland Quarterly Journal of the Medical Sciences, April, 1858.
[4] Union Médicale, 1858, p. 407.
[5] Dr Burdon Sanderson quotes a case in which it appeared eighteen hours after the patient had been apparently in perfect health. Contributions to the Pathology of Diphtheritic Sore Throat, etc., Brit. and For. Med.-Chir. Rev., January, 1860.

enon, and it is quite exceptional for it to persist after recovery. It seldom results in anasarca, and only very rarely in uræmia. In short, it is not by any means a dangerous symptom, and recent observations have fully confirmed the dictum of Trousseau,[1] that it has only a limited signification in relation to prognosis and treatment.

The exudation of *false membrane* is an almost invariable phenomenon of diphtheria. There are only two classes of cases in which it may be absent, viz., those in which death from blood-poisoning occurs before the exudation has time to form, and those in which the local process is not severe enough to result in the formation of a definite membrane. This class has been described by Dr. Michel Peter[2] as "Diphtherite *sine diphtheria*." False membranes may form in the course of the disease upon any part of the mucous surfaces which are exposed to the air. As a rule, they attach themselves by preference to the more prominent parts. They may extend from the pharynx to the epiglottis and ary-epiglottic folds, and from thence by the ventricular bands and vocal cords, into the trachea, and may only be arrested in the smaller bronchi. They may spread upward into the nasal passages, covering the whole cavity and following the windings of the turbinated bones. They may appear at the orifice of the nares and attack the excoriated skin around them: they may extend up the lachrymal duct and show themselves upon the conjunctiva. In some rare cases they have been known to extend into the œsophagus, and they occasionally cover the tongue and the mucous membrane of the lips. In women who are suckling infants the disease sometimes appears on the nipple. In both sexes it may attack the mucous membrane near the orifice of any of the internal passages. External wounds of any sort are liable to be covered by false membrane. In short, no part of the body which is at once open to the air and uncovered by a thick epidermis, is free from the liability of local infection and the consequent formation of false membrane. The exudation may take place within a few hours of the invasion of the disease, or may be delayed for four or five days. The first sign of exudation consists in the infiltration of the superficial layers of mucous membrane with a yellowish substance, which raises the affected parts above the level of the surrounding surface. The further changes which take place have been already described. When the first membrane has been removed artificially, fibrinous exudation may again form, or the surface may gradually heal. When, however, the membrane has become detached of its own accord, recurrence in the same spot is rare.

The symptoms of *fever* in diphtheria may either be very marked or almost absent. In the severest and most malignant cases the temperature is often quite low. There is never any tendency to extreme hyperpyrexia. In the usual run of cases it would appear that the variations of temperature follow a fairly definite course. Trousseau states that there is a rather acute development of fever at the time of the attack, but that the feverish symptoms diminish on the second day, and cease on the following or next day. Wunderlich considers that the temperature in diphtheria is of little prognostic value,[3] but Faralli, to whom I have already referred, has shown that there is a definite pyrexial cycle in cases of diphtheria, which furnishes data both for diagnosis and prognosis. The observations which he has made prove that fever is a phenomenon commonly present

[1] Trousseau: Op. cit. vol. ii. p. 538.
[2] Thèse de Paris, No. 270, Paris, 1859.
[3] Temperature in Diseases (New Sydenham Society's Translation), p. 367.

in diphtheria. The elevation of temperature is rapid, and even in slight cases it frequently rises as high as 104° in a few hours, falling gradually until the normal point is reached on the fourth or fifth day. In cases of moderate severity the temperature again rises toward the fourth day, but seldom regains the height of the first elevation. The exacerbation is due to the appearance of fresh diphtheritic patches on parts previously healthy, or, more frequently, to the appearance of glandular enlargements, the result of secondary infection. The effects of this secondary infection are clearly observed in severe cases which pass into the typhoid state. In these the temperature at first follows the same course as in the milder cases; that is, it rises rapidly and falls steadily until the third or fourth day. At that date it rises again, with some irregularity, but with a certain relation to the extension of the local disease, and to the putrefactive changes in the membranes. In favorable cases a second steady fall succeeds the second elevation, while in fatal cases the temperature continues to rise until the last. The natural course of the temperature may at any time be modified by the supervention of impeded respiration, which will have the effect of reducing it. Dr. Faralli's observations were not simply confined to pharyngo-laryngeal diphtheria. In a case in which diphtheria affected a wound, he obtained the same results. The temperature rose within a few hours to over 105°, before the false membrane was clearly developed. It fell to normal on the third day, while the infiltration was at its maximum.

Cutaneous eruptions are not uncommon in some epidemics of diphtheria, especially among children. Their most common situations are the neck and chest; occasionally they make their appearance on the face, abdomen, and thighs. A rash is most frequently met with in the severest cases. The date of its appearance is not definite, and its duration is very variable. Sometimes it disappears in a few hours, in other cases it persists for several days. The rash of diphtheria generally more or less resembles the rash of scarlet fever, and consists of minute red isolated spots, which disappear on pressure. It differs from that of scarlet fever in the fact that it is never followed by desquamation.

Sequelæ.—Setting aside extreme debility and a disposition to cardiac syncope, which may be considered rather as characteristics of the disease itself, the only serious sequelæ of diphtheria are various local paralyses. These paralyses are liable to follow any case, however slight; they may be partial or complete, and they may either limit themselves to single groups of muscles, or may involve in succession almost the whole voluntary muscular system. Their advent is always gradual, and as a rule they declare themselves during the second or third week after the complete healing of the local lesion. Trousseau,[1] however, quotes a case in which they became manifest three days before the disappearance of the false membrane. On the other hand, they may be delayed until as late as the sixth week of convalescence. In any case their advance is gradual, and they may continue to extend for weeks after their first appearance. The muscles most frequently affected are those of the soft palate and pharynx, of the eye, and of the extremities. It is much more rare for the muscles of the larynx and trunk to be implicated, while those of the bladder and rectum are still more seldom affected, and those of the face, almost always, though not invariably, escape. Concurrently with the paralysis, there is impairment of muscular, and sometimes of cutaneous, sensibility. The

[1] Gazette des Hôpitaux, 1860, Nos. 1 and 5.

muscles generally respond languidly to both galvanism and faradism, while the patient complains of numbness and prickings in the paralyzed parts. More rarely there is pain or hyperæsthesia. The affected muscles occasionally undergo some degree of wasting, and in some cases their diminution in bulk is very considerable. The first muscles to be affected are usually those of the soft palate and pharynx, which are almost always affected more on one side than the other.[1] The soft palate and uvula hang loosely, and cannot be drawn up at will. There is often also some diminished sensibility of the uvula, fauces, and epiglottis. The voice loses its resonance, and assumes a nasal character, while articulation is more or less embarrassed, and the patient is soon tired of talking. Swallowing is invariably rendered difficult, and fluids frequently regurgitate through the nose, or pass into the larynx. Occasionally life can only be sustained by the use of the œsophageal feeding tube. The paralysis of the pharynx generally impedes expectoration, and the secretion accumulates in the throat, and causes considerable discomfort.

Paralysis of the larynx is much less common than the palsies already described, but in rare cases it may appear even without other parts being affected. The paralysis may involve the whole muscular apparatus of the larynx, or may limit itself to single muscles. In the former case the vocal cords will be seen on laryngoscopic examination to remain motionless during phonation, occupying the post-mortem position. The voice is almost entirely lost, and any increased exertion leads to considerable dyspnœa, not from paralysis of the abductors, but from loss of power of the adductors, and consequent inability "to hold the breath—" an act which is especially necessary for delicate persons when making an effort. The muscular paralysis is occasionally associated with loss of sensibility of the mucous membrane of the epiglottis, in which case portions of food are more likely to make their way into the larynx than when the pharynx alone is affected. Such an accident may give rise to very serious symptoms. Where the paralysis only involves single muscles, it is the abductors which generally suffer, but often only one cord is affected. Two cases of permanent paralysis of the recurrent nerve, following diphtheria, have come under my notice.

Usually, the sense of taste is more or less blunted, and there is a loss of sensibility in the veil of the palate. In other cases the patient complains of numbness and a pricking sensation in the tongue and soft palate. The muscles of the eye are the next to suffer. Indeed, in some cases, they become paralyzed at the same time as the muscles of the palate. The patient first notices that it is getting more and more difficult for him to read small print. The effort tires him, and causes pain in his eyes; soon his vision becomes quite indistinct, and he suffers from flashes of light before the eyes. He does not, however, lose the power of seeing distant objects. At a later period there may be double vision, giddiness, and squinting, from palsy of the oculo-motor muscles. The earlier symptoms are due, according to Donders,[2] to impairment of accommodation from palsy of the ciliary muscles. The chief affection of the sense of sight, therefore, depends on paralysis of parts supplied by the lenticular ganglion of the sympathetic chain, as the pharyngeal paralysis appears to be due to impairment of Meckel's ganglion, and these facts have led Dr. Hughlings Jackson[3] to inquire, in cases of diphtheritic paralysis, for a

[1] See p. 85.

[2] New Sydenham Society's Translation, 1864.

[3] Ophthalmology in its relation to General Medicine: British Medical Journal, May 12, 1877, p. 505.

corresponding affection of the sense of hearing, such as would be likely to result from interference with the function of the otic ganglion. He has hitherto only met with one such case, that of a medical man. The affection was not sufficient to impair his hearing for ordinary purposes, but "enough to render music unintelligible." In fact, as Dr. Jackson says, we should not expect deafness as the result of diphtheritic paralysis, but only slight interference with the power of appreciating high-pitched sounds. It is impossible to tell as yet how frequent such an affection may be in cases of diphtheritic paralysis. As far as our knowledge at present goes, it is little more than a pathological curiosity. Next in order to the muscles of the eye, those of the extremities most frequently show signs of paralysis. The lower extremities are usually the first to be affected. The patient first suffers from numbness and tingling in the feet. Soon, on attempting to walk, his legs begin to tremble, and he feels as though he were walking on air. The difficulty gradually increases, his movements grow more and more clumsy, until at length he loses all power over his legs, and becomes a helpless cripple. The muscles of the affected parts feel flabby to the touch, and they refuse to respond to the electric current. Cutaneous sensibility is also much impaired, or entirely abolished, especially in the soles of his feet. The same symptoms may occur in the upper extremities. There is, first, numbness and formication in the fingers, then increasing clumsiness of movement, and finally, complete paralysis.

The last muscles to be affected are generally those of the neck and trunk. Paralysis of the former in its worst forms deprives the patient of the power of raising or turning his head, which falls helplessly backward, forward, or to one side. Paralysis of the latter renders turning or moving in bed impossible, and at the same time causes considerable embarrassment to respiration from the implication of the intercostals. When the diaphragm is also paralyzed, as in rare cases it is, the difficulty of breathing is enormously increased, and the patient runs the greatest risk of dying from asphyxia. If, however, the paralysis be not complete, the danger may be warded off, and the patient may gradually recover. Concurrently with the paralysis of the extremities in the most severe cases, there is often incontinence of urine and fæces from palsy of the sphincters of the bladder and rectum. In men the sexual function is also affected in such cases, and the patient becomes temporarily impotent.

Having continued for a period varying from six weeks to half a year, these paralyses gradually disappear in the order in which they appeared, the duration being in each case proportionate to the degree of paralysis. If no unfortunate complications lead to a fatal result, eventual recovery of muscular power may almost invariably be counted upon; but in most cases the patient continues for a long time to experience some degree of weakness in the affected parts. Lastly, it is well to remember that the severity of the paralytic symptoms bears no proportion whatever to the severity of the antecedent disease. The loss of power may occur in a marked degree after even the most trivial attacks.

Diagnosis.—In some cases of diphtheria an absolute diagnosis may be almost a matter of impossibility, at any rate in the earlier stages of the disease. The difficulty generally arises in those cases which deviate from the normal type in the direction either of unusual mildness or of unusual severity. Very mild cases, in which the false membrane is either absent or late in appearing, may easily be confounded with ordinary catarrhal sore throat. The diagnostic criteria are both few and indefinite. A his-

tory of infection, or the epidemic prevalence of diphtheria, may in some cases be of service in forming an opinion, but more oftener the practitioner has to trust to other data. In the case of the diphtheritic sore throat, without false membrane, the congestion is at once more limited and more intense than in pharyngeal catarrh; it often affects one lateral half of the soft palate, or one tonsil, while the catarrhal process has usually a more general distribution. In simple sore throat the surface of the tonsils may be covered here and there with patches of deposit, which might possibly mislead an ignorant or incautious observer; but such deposits will invariably be found to be soft, semi-fluid, and easily removed. They are, in fact, nothing more than the modified secretion of the congested mucous structures. In diphtheria, moreover, there is often albuminuria, and a degree of prostration out of proportion to the severity of the local changes. In many cases, in the absence of false membrane, the practitioner must rest content with a diagnosis founded upon unsatisfactory criteria. In other cases, however, the sudden development of exudation and the appearance of serious symptoms of general infection may clear up all doubt; while in still rarer instances the supervention of muscular paralysis during convalescence will solve the problem in a quite unexpected manner. It is hardly necessary to add that, in all cases of suspected diphtheria, it is the bounden duty of the practitioner to make a most thorough examination of the interior of the throat, supplementing it, if possible, by the use of the laryngoscope and rhinoscope. These instruments will often bring to light patches of exudation, and will thus give very material help toward a satisfactory diagnosis.

The cases in which diphtheria appears in an exceptionally severe form may offer still greater difficulties in the way of diagnosis than even mild cases. A patient, for instance, is suddenly struck down by intense general blood-poisoning, and rapidly passes into what is named the typhoid state. If inspection of the fauces is neglected in such a case, the physician may experience the greatest perplexity as to the nature of the disease. Even the fauces may appear healthy, and the case be still one of diphtheria; for the membrane may not as yet have had time to form, or may have formed beyond the range of sight. The only aid to diagnosis in such a case will be found in the character of the prevailing epidemic. Malignant diphtheria very rarely occurs in an endemic form.

Apart from the above difficulties, diphtheria may simulate, and be simulated by, scarlet fever, confluent herpes of the throat, acute tonsillitis, and acute laryngitis. There can be no doubt that, in many cases, diphtheria has been mistaken for scarlet fever. The severe constitutional disturbance, the sore throat, and the rash, which is a common symptom in some epidemics of diphtheria, are all liable to mislead the observer. But the points of difference are fairly well marked. The constitutional symptoms are usually slighter in diphtheria; there is, as a rule, less anorexia, but more prostration. The throat in scarlet fever is uniformly reddened, and if it be the seat of any membraniform deposits, these are soft and easily detached. The larynx, moreover, is only very exceptionally attacked. There may be albuminuria in either disease, but hæmaturia, which is scarcely ever known to occur in diphtheria, is not uncommon in scarlet fever. The distinctive characters of the rashes have already been described.

Acute tonsillitis at its outset may simulate the inflammatory form of diphtheria. In both there is considerable constitutional disturbance and difficulty of swallowing; in both the throat affection has a more or less uni-

lateral tendency, and commences with intense congestion. In tonsillitis, however, the inflammation either subsides, or rapidly passes into suppuration, and thus removes all cause of difficulty.

Confluent herpes of the throat is not a common disorder, and is not, therefore, often likely to give rise to difficulties in practice. Trousseau,[1] however, has laid down the diagnostic distinctions between the two diseases with considerable detail. Herpes is usually ushered in with considerable constitutional disturbance, but the temperature rarely rises higher than 102° or 102.5° Fahr., and it quickly subsides. The pain in the throat is of a peculiar smarting character. Herpes has no tendency to spread beyond the seat of its first efflorescence. Thus, if in a doubtful case the morbid process is found extending to the tonsils, to the larynx, or to the nose, herpes may be excluded. Of course the simultaneous appearance of herpes on the hip will be of great help in forming a diagnosis.

The diagnostic distinctions between laryngeal diphtheria and catarrhal laryngitis will be found under the head of "Croup."

Pathology.—The characteristic product of diphtheritic inflammation—the false membrane—is a tough dry substance resembling fibrin, or the buffy-coat of the blood. In color it is yellowish, or grayish white; it is firm and elastic, but it breaks across suddenly when stretched. The addition of acetic acid causes it to swell up and become transparent; it is dissolved by caustic alkalies. It is insoluble in water, and yields to it neither gelatine nor albumen. It thus closely resembles fibrin in most of its qualities. The membrane may vary from a thin and transparent pellicle to a skin of considerable thickness. The character of the exudation varies according to its age. In the earlier stages the different patches of membrane are more or less isolated, they are surrounded by mucous membrane in a state of intense hyperæmia, they project only very slightly above the mucous surface, and they cannot be removed without considerable force. Later on, the patches are found to have coalesced, they have become firmer and thicker, and evidently project higher above the surrounding surface. In the next stage these edges become loosened, and show a tendency to curl up, giving the exudation a more or less cupped appearance. Pus gradually accumulates beneath it, until it detaches itself, leaving the subjacent mucous membrane in a state of catarrh.

According to the most recent researches, the exudation in *pharyngeal diphtheria* is seen under the microscope to consist exclusively of cells. The naked-eye resemblance to coagulated fibrin is due to a peculiar degeneration of the epithelial cells, and to an equally peculiar fusion of them one with another. The cells manifestly contain more solid matter than normally, but the precise character of the infiltration is as yet uncertain. On examining a section of membrane under the microscope, it is seen to consist of thin changed cells, fused together in various directions, and leaving a system of branching fissures, which permeate the whole membrane. The most superficial cells are twice as large as lymph corpuscles. They gradually decrease in size as we proceed deeper, until those which are in immediate contact with the mucous surface are almost indistinguishable from normal cells. Here and there, scattered throughout the membrane, are often seen minute extravasations of blood, which, originally formed on the mucous surface, have become separated from it and encapsuled by successive layers of degenerated cells. To sum up in

[1] Op. cit., vol. ii. p. 439.

the words of Rindfleisch,[1] "the false membrane is undeniably produced by the separation of young elements from the irritated mucous surface and by their gradual stiffening, sclerosis, glassy swelling, or whatever term we may choose to apply to their degeneration." In course of time the mischievous process comes to a standstill. The cells secreted by the mucous membrane no longer undergo the abnormal degeneration; pus cells appear in increasing quantities between the mucous surface and the false membrane, and soon lead to the final separation of the latter. The exudation also disappears to some extent by undergoing a process of softening, the cells becoming granular and fatty, and the network undergoing gelatinous degeneration. This, though not an uncommon termination in favorable cases of tracheal diphtheria, is much rarer when the false membrane is formed in the pharynx.

In describing the symptoms of diphtheria, it has been pointed out that in the earliest stages of the disease the mucous membrane is inflamed and swollen, but is soon coated with false membrane, and becomes hidden from view. If the disease progresses favorably and the case is not very severe, on separation of the lymph, the mucous membrane is seen to be smooth, and often somewhat paler, than in a state of health; but, if the affection has been at all violent, more or less ulceration of the mucous membrane will be present. Occasionally the morbid process does not stop at ulceration, but gangrene results, and there is considerable loss of tissue. In many fatal cases the gangrenous process is in active operation, and its peculiar odor becomes evident on the post-mortem table, if not during life. The idea entertained by the ancient physicians, that the disease was a gangrenous process, was, it need scarcely be observed, derived from the appearance of the false membranes themselves, which, whether white or subsequently discolored, have very much the aspect of an eschar or slough. This is, of course, only a delusive appearance, and our modern knowledge of the gangrenous process in diphtheria is based on the post-mortem examination of the tissues *beneath* the false membrane. In the severer forms of the disease there is, in addition to the changes above described, an exudation of fibrin into the subepithelial connective tissue. The exudation and infiltration sometimes compress the nutrient vessels of the part, and thus arrest its blood supply. Necrosis of the involved tissues results, and leads to the formation of a slough, which is, in course of time, separated from the healthy parts. On the slough becoming finally detached, there is left an ulcer of variable depth and extent. In several cases I have known the patient recover with the loss of his uvula, and with a portion of one or both tonsils destroyed. It is more common, however, in cases of recovery after gangrene to find large and puckered cicatrices resembling those which are seen as the result of syphilitic ulceration.

In addition to the inflammatory products of diphtheria, there are certain parasitic phenomena. The idea that diphtheria is of parasitic origin was first put forward by Professor Laycock[2] and subsequently revived by Jodin.[3] More recently Oertel[4] has maintained the parasitic theory with great vigor, and has been followed by many German observers. Oertel

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[1] Lehrbuch der Pathol. Gewebelehre, II. Auflage, p. 310, Leipzig, 1871.

[2] Medical Times and Gazette, May 29, 1858.

[3] De la nature et du traitement du croup, etc.: Revue Méd., t. i. pp. 22 and 134, Paris, 1859.

[4] Ziemssen's Cyclopædia of Medicine, vol. i. p. 589.

contends that certain definite forms of vegetable life, especially the spherical bacteria, called *micrococci*, and the smallest forms of *bacterium termo*, are invariably associated with the diphtheritic process. The grayish white hoarfrost-like patches which appear on the mucous membrane at the very commencement of the disease, contain, he says, luxuriant growths of micrococci. They are always present in diphtheritic membranes, and they are also found in varying quantity in the blood, whenever such membrane exists. The quantity of them present in any case, moreover, bears, it is affirmed, a direct relation to the intensity of the morbid processes; they multiply as the disease advances, and diminish with its retreat. Oertel states that the special form of micrococcus is never present in simple inflammation of the fauces or in mercurial stomatitis; but, that if the diphtheritic process supervenes on these disorders, it at once makes its appearance, and quickly displaces the more common forms of bacteria previously present. According to Oertel, and some other experimentalists (*see* Etiology), after the inoculation of the different tissues of animals with diphtheritic exudation, it has been found that the micrococci force their way amongst the cellular elements, crowd into the blood and lymph vessels, which they render impermeable, infiltrate the muscles, and lead to their degeneration, and even reach the kidney, where they excite the inflammation which is so common a complication of diphtheria. Eberth [1] has gone so far as to declare that *without micrococci there can be no diphtheria;* while in Italy Giacchi [2] believes that a parasite is as necessary in the pathogenesis of the disease, as the *oïdium vitis* is in the production of disease of the grape. Letzerich [3] has found another fungus—the *zygodesmus fuscus*—which he believes is the essential cause of the disease. The conclusions of Oertel and Letzerich have, however, been directly controverted by Senator,[4] who has found the *leptothrix buccalis* in diphtheria, and who considers the minute round bodies described by Oertel (as the spherical bacteria) to be the spores of the leptothrix. According to Senator the same fungi are found in diphtheria as in ulcerative, aphthous, and mercurial stomatitis. In February, 1874, I examined seven cases for epiphytes, and succeeded in finding what is commonly described as "the leptothrix buccalis" in five instances. In every case, however, the fungus was in the superficial layer of the lymph. The importance of the presence of fungi in diphtheritic deposits is controverted by Dr. Beale,[5] whose authority as a microscopist must carry great weight in this country. This observer maintains that "vegetable germs are present in every part of the body of man and the higher animals, probably from the earliest age, and in all stages of health. . . . Millions of vegetable germs are always present on the dorsum of the tongue and in the alimentary canal." Dr. Beale further states[6] that "active bacteria introduced amongst the living matter of healthy tissues will die, although the most minute germs present which escape death may remain embedded in the tissue in a perfectly quiescent state." He thinks also "that there are very few morbid conditions that are unquestionably solely due to the growth and multiplication of vegetable fungi."[7]

The changes which may take place in other tissues in the course of an

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[1] Zur Kenntn. der bacterit. Mykosen, 1872.
[2] Natura e Terapia dell' angina difterica: Lo Sperimentale, Nov. 1872.
[3] Virchow's Archiv., Bd. xlv. et seq.
[4] Archiv. für Pathol. Anatomie u. Physiol., Bd. lvi. No. 12, 1872.
[5] Disease Germs, London, 1872, p. 65 et seq.
[6] Ibid. p. 71.
[7] Ibid. p. 78.

attack of diphtheria are very various : The *parotid* and *submaxillary glands* which Dr. Samuel Bard [1] first pointed out as being frequently swollen, have been recently shown by Doctors Balzer and Talamon [2] to be the subject of distinct pathological changes. The cells of the acini are generally either swollen and filled with a homogeneous mucoid material, or replaced by quantities of small round cells. Here and there are also frequently minute collections of pus. The *lymphatic glands* of the neck are almost invariably found to be more or less enlarged. On section they are redder than natural, and there is an evident increase in their cellular elements. The tissues around them, which during life were brawny and tender, are found at the autopsy to be infiltrated with serum and with scattered pus-cells. Often they present minute extravasations, while, in rare cases, considerable masses of blood have been found effused in the cellular tissue surrounding the glands.

The *lungs* may be the seat of very varied changes. The bronchial tubes are always inflamed—the inflammation generally being catarrhal, but sometimes purulent ; in many cases, however, it is plastic, and then most commonly occurs on the fourth or fifth day of the disease. On laying open the bronchi, the false membrane is found attached to their walls, or lying loose in their channels. The membrane is never equally extended throughout the whole system of tubes, but seems to have a preference for those branches which run in a vertical direction. The fact of one of the lungs being bound down by pleuritic adhesion would seem especially to attract the morbid process in that direction. Exudation is not unfrequently found to extend to the minutest bronchial ramifications, in which case the alveoli are usually more or less implicated, and contain fibrinous threads, pus-cells, and, in some cases, blood corpuscles. As a rule, the lungs are more or less engorged and œdematous, especially at their bases ; and frequently there are extensive patches of pneumonia of a low type, with emphysema, or more often mere insufflation of the air cells [3] in the immediate vicinity. In other cases scattered lobules are found collapsed and void of air from occlusion of the smaller bronchi, or one of the lobes is the seat of more or less extensive pulmonary apoplexy. According to Peter,[4] 59.50 per cent. of the cases of broncho-pneumonia occur between the second and the sixth day. The *heart* has often an appearance of perfect health, but, in cases where death has occurred from general blood-poisoning, its muscular tissue is soft and friable, and contains scattered extravasations of blood. Under the microscope the muscular fibres show signs of fatty degeneration, and the blood is fluid and tarry. In other cases the opposite condition is sometimes found, coagula of considerable size being met with in the cavities of the heart and in the large vessels.[5]

The *spleen* and *liver* are often perfectly natural, but occasionally they are much engorged, and sometimes their capsules present extravasations of blood. The inner surface of the *stomach* may be the seat of ulcers and sloughs, and hemorrhagic exudations are occasionally met with, both in that situation and beneath the lining membrane of the intestines and bladder. The *kidneys* present marked changes in about half the fatal cases of diphtheria. They are swollen and engorged, and often contain

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[1] Loc. cit.

[2] Revue Mensuelle, le 10 juillet, 1878.

[3] Jenner: Loc. cit. p. 38.

[4] Gazette hebdom., 1864.

[5] Richardson: Med. Times and Gaz., 1856. Meigs: American Journ. of Med. Sci., April, 1864. Beverley Robinson: Thèse de Paris, 1866 ; and other authors.

scattered collections of blood. In other cases the changes are only visible under the microscope. Here the epithelial cells lining the tubules are found swollen and granular, and they have often undergone extensive proliferation, the crowded masses of young cells filling the tubes, and forming epithelial casts. Occasionally the Malpighian tufts and the tubules contain blood, and the latter are sometimes occupied by hyaline coagula.

The changes in the *brain* depend on the mode of death, and, if the patient succumbs to asphyxia, there is venous engorgement of the membranes and cerebral substance, and minute extravasations of blood. Pus and lymph have also been found on the arachnoid membrane, when the septicæmia has been very marked. In many cases where death has taken place whilst the patient was suffering from extensive diphtheritic paralysis, the muscles have presented no marked alterations ;[1] and Morelli[2] goes so far as to say that "the anatomico-histological changes found in such cases are inadequate to explain the various forms of diphtheritic paralysis and paresis." In fact, the almost invariable restoration of these functions would seem to argue conclusively against these muscles being the seat of any serious degenerative change. In exceptional cases, however, serious and extensive lesions have been discovered. They were first observed by Charcot and Vulpian[3] in a case of paralysis of the velum palati. The motor nerves of the part consisted of tubules emptied of their medullary substance, their neurilemma containing numerous granular cells, elliptical in form, and in some instances nucleated. In one case Buhl[4] found the nerves thickened at their roots, and the sheaths of the nerves crowded with lymphoid cells and nuclei. In a case of Oertel's[5] the muscles had undergone extensive fatty degeneration, while the substance of the brain, spinal cord, and spinal nerves was the seat of numerous extravasations of various dates. There were also other marked changes in the spinal cord. Dr. Hughlings Jackson[6] has pointed out that muscles supplied in part through ganglia of the sympathetic system are especially prone to be the subject of paralysis. This is true of diphtherial amaurosis, and of the paralysis of the palate, and it would seem that the nerve-cells which give way are most largely represented in the higher ganglia of the sympathetic systems.

The most cursory study of the general pathology of diphtheria suffices to assure us that it is an acute general disease, with certain local manifestations. The *primary septicæmia* is due, in the first instance, to the specific poison, but absorption from the decomposing lymph is no doubt also a cause of *secondary infection*. In all cases the attack is associated with some degree of constitutional disturbance, while in the severest forms there is extreme disorganization of the blood and consequent implication of nearly every tissue in the body. The general infection is shown at a very early stage, as well as at a period when the local manifestations have disappeared. Besides the constitutional disturbance by which the attack is ushered in, there is the frequent derangement of the renal function, the marked prostration of strength, the functional disturbance of the heart, and at a later period the extensive implication of the nervo-muscular sys-

[1] See two cases reported by Dr. Hermann Weber : Virchow's Archiv, vol. xxiii. p. 115.

[2] Lo Sperimentale, Dicembre, 1872.

[3] Compt. rend. de la Soc. de Biol., 1862.

[4] Ziemssen's Cyclopædia, vol. i. p. 656.

[5] Ibid. p. 657.

[6] Loc. cit.

tem. The local symptoms—the false membrane with its parasitic growths—must be looked upon as the first evidence of constitutional poisoning, in fact, as the first of the secondary phenomena.

Prognosis.—The mortality of diphtheria varies chiefly according to the age of the patient and the character and stage of the epidemic, and these points must consequently be borne in mind in giving a prognosis. The relative proportion of deaths to cases is by no means constant. In some epidemics it has exceeded 50 per cent. According to Dr. Borgiotti's statistics [1] of the recent Florentine epidemic, out of 1,546 persons attacked in the years 1872 and 1873, 881 died; but as Dr. Borgiotti elsewhere [2] remarks, owing to the incompleteness of the health-returns, or, in other words, the probable omission of slight cases, these figures should be looked upon rather as the relation of "the *gravely affected* to the *dead.*"

The dangers which are most to be dreaded at the outset of an attack are, on the one hand, extension of the disease to the larynx, and, on the other, the severe blood-poisoning. In the former case the patient is exposed to imminent risk of death from asphyxia. In the latter a fatal result may occur from collapse, or the patient may rapidly sink with typhoid symptoms. At a later period, a fatal result may be brought about by repeated attacks of syncope, by general prostration without manifest cause, by exhaustion from constant and uncontrollable vomiting or from severe hemorrhages, or by inflammatory complications such as secondary pneumonia or acute nephritis. In the case of infants, death has resulted from inability to suck, owing to implication and consequent stoppage of the nasal passage. Death during convalescence most commonly results from paralysis of the heart, or of the muscles of inspiration, or from intercurrent disease of the lungs or pleura, or from general failure of nerve-force and exhaustion.

With regard then to the data on which a prognosis must be formed, the most important *general* consideration is the character and mortality of the prevailing epidemic. It may, perhaps, be laid down as a rule that of the cases in which a definite false membrane is present, one-third at least will probably prove fatal. Apart from other less known causes, the mortality in any epidemic will vary according to the form of the disease and according to the proportion of children to adults attacked, diphtheria being, for obvious reasons, far more fatal amongst children than adults. It must also be borne in mind that in certain families diphtheria has an exceptional tendency toward a fatal result. With regard to the *special* symptoms on which to found a prognosis, the following considerations chiefly deserve attention: High temperature, extreme prostration, hemorrhages, or urgent vomiting at the commencement of an attack are signs indicative of extensive general infection, and must therefore be looked upon as of very serious prognostic import. Valuable information may be gained from the character and extent of the false membrane. *Ceteris paribus*, the prognosis is serious in proportion to the thickness and extent of the exudation. When the exudation shows a disposition to extend rapidly, the danger is very considerable, as the extension is very likely to take place in the direction of the larynx. Prostration and a tendency to syncope are alarming signs at any period of an attack; their advent is often heralded by a very rapid or a very slow pulse, with muffling of the heart's sounds, and intermittency of its pulsations. The

[1] Loc. cit. [2] Atti dell' Accademia, etc. p. 16.

presence of albumen is not, as I have already pointed out, a symptom of a serious import. During convalescence the extension of muscular paralysis to the muscles of respiration is the most alarming sign.

Treatment.—The symptoms of diphtheria are due, as I have shown, in part to a general blood infection, and in part to a local specific inflammation. Each of these pathological processes appears to run a cyclical course; in each the deviation from health is only a temporary one, which after lasting for a variable period, shows a tendency to subside and to terminate in the re-establishment of normal action. Each process, however, is attended with its own special danger, which may lead to a fatal issue before the return to health. As regards the general condition it is the *intensity* of the morbid changes which constitutes the great danger; locally, the risk lies in the *occurrence of the exudation in a perilous situation.* The main objects in the treatment, therefore, will be to offer every possible resistance to the dangers arising out of these features. This will be accomplished in part by general and in part by local means, and neither form of treatment must be neglected.

General Treatment.—This should be directed toward husbanding and supporting the patient's strength by every available means. He should be placed, if possible, in a large, cheerful, and well-ventilated room, the air of which must be at once warm and moist. The temperature should be kept as nearly as possible between 60° and 65° Fahr. The patient's diet must be at once nutritious and digestible. Concentrated beef-tea, or beef-tea jelly, milk, and egg-flip must be regularly given at short intervals. Dr. Massei,[1] who has seen a great deal of the disease at Naples, has pointed out that milk is often digested with difficulty in these cases, and under such circumstances it must be combined with lime water. Especial attention must be paid to feeding during the night, when the vital power of the patient is usually at its lowest ebb. There is often great distaste for food; in other cases swallowing is attended with considerable pain, while occasionally everything that is swallowed is immediately rejected. It is, however, the duty of the attendants to secure the due nourishment of the patient in spite of every difficulty. There are few cases of diphtheria in which systematic feeding does not constitute the most important part of the medical treatment. The administration of alcohol in small quantities is almost always advisable. In some cases, it is true, it may not be called for during the whole of the attack, but very often it supplies us with the best chance of saving the patient's life, and it must then be pushed with a boldness rarely needed in other forms of disease. Small doses of alcohol will usually be found sufficient in the earlier stages of an attack; two ounces of brandy or four ounces of wine in the twenty-four hours may be prescribed for an adult, and proportionate quantities for a child. In other cases, however, larger doses are required from the very commencement. But whatever be the earlier symptoms the physician must always be prepared to increase the dose rapidly, if the appropriate indications—attacks of syncope, irregular, very frequent, or very slow pulse, and delirium—present themselves. In these circumstances a high temperature does not in itself contra-indicate the employment of stimulants. In all cases it is necessary to keep a careful watch upon the pulse, which will give invaluable information as to the need for alcohol. Rapid and fatal failure of the heart often supervenes quite suddenly and unexpectedly, and the first indication of such failure is the signal for the

[1] Intorno alla Cura dell' Angina Difterica, Napoli, 1875, p. 54.

unsparing use of the drug. Patients suffering from the exhaustion and prostration of diphtheria bear large amounts of stimulant without any of the usual intoxicating effects, and as much as twenty ounces of brandy have been given to an adult within twenty-four hours with manifest benefit. Champagne may occasionally be substituted for brandy, but this wine, in the active state of the disease, often causes pain in deglutition, and, as a rule, is more useful during convalescence. Whenever there are signs of approaching cardiac failure, it is important to keep the patient in bed with his head low, and to interdict any movement whatever. The neglect of this precaution has often been attended with fatal results.

Before passing to the strictly therapeutic treatment it is necessary to make a few remarks on bloodletting. It was at one time thought that general bleeding had a favorable influence on the spread of the exudation. Home strongly advocated it, and recommended in addition the application of leeches to the upper part of the throat. Bretonneau invariably used the lancet in his earlier cases. But experience soon taught him that depletion neither extinguished the disease nor prevented the formation of false membrane, and he reluctantly abandoned it. Guersant, Trousseau, Bouchut, and Empis all came to a similar conclusion, and since their time the treatment by venesection has not been revived. Considering the serious danger of death from syncope and exhaustion to which patients are exposed when suffering from diphtheria, it is a matter for wonder that such treatment was ever thought of. The only rational excuse for its adoption was the theory that it prevented the extension of the local process. It has now, however, been almost universally admitted that general bloodletting has no influence whatever, unless it be an injurious one, upon the exudation. The same may be said, with scarcely less emphasis, of local depletion. The application of leeches to the throat may indeed relieve the pain and swelling, but such relief is dearly bought at the loss of even small quantities of blood, and the serious risk of diphtheritic infection of the leech-bites.

Of the general remedies which have been recommended in diphtheria there are four kinds, viz.: (1) The recuperative agents; (2) the alleged specifics; (3) the antiseptics; and (4) the expectorants. Some remedies, it will be at once perceived, belong to more than one of these divisions.

(1.) Of the *recuperative agents* iron and quinine are the most entitled to consideration. Of these iron is undoubtedly the most useful, and the profession is indebted to Dr. Heslop,[1] of Birmingham, for proving its value in diphtheria. It should be administered frequently and in large doses. Thirty minims of the tincture of the perchloride may be given to adults every two or three hours, and proportionate doses to children. It is well to combine it with glycerine, and, of course, it must be diluted with water. The general effect of the drug is often extremely favorable, and its influence is equally well marked, the soreness and pain in the throat being considerably relieved after each dose. The double effect is more surely procured by prescribing one of the persalts in preference to the less astringent protosalts. Quinine is occasionally required in the course of an attack of diphtheria. The special indications for its use are headache with high temperature, vomiting, and the symptoms of septic poisoning. In such cases the drug should be given in full doses, and should not be persisted in if benefit fails to result in thirty-six, or at the most, forty-eight hours. As a rule, however, quinine is more useful after the

[1] Medical Times and Gazette, May 29, 1858.

more serious symptoms have abated, when it may be very suitably combined with iron and a mineral acid. Morphia and chloral are occasionally necessary to combat continued sleeplessness, and to ward off the exhaustion which is its invariable consequence.

(2.) The principal *alleged specific remedies* are: mercury, sulphide of potassium, bromine, and the balsams of copaiba and cubebs. The treatment of diphtheria by mercurials was at one time not less common than the practice of depletion, and it received a certain degree of support from the favorable influence which dusting with calomel is found to exert on diphtheritic wounds. But experience has long taught us that the general influence of mercury on the system rather promotes than checks the spread of the exudation. At one period mercury was vigorously pushed by Bretonneau,[1] but with very unsatisfactory results. From that time the use of mercury has been gradually discarded, and with such general consent that no one has since ventured to reintroduce it. Of the other alleged specifics, sulphide of potassium has long been regarded by Swiss physicians as a valuable specific, but it often produces both sickness and diarrhœa, and should not be employed. Bromine, which is best administered in the form of bromide of potassium, has not answered the expectations of its first advocate.[2] The well-known action of copaiba and cubebs on the mucous surfaces, led Dr. Trideau [3] to try these remedies in croup and diphtheria, and his experiments have been still further elaborated by Bergeron.[4] Dr. Beverley Robinson [5] has also lately strongly recommended the use of cubebs in the catarrhal form of diphtheria. This physician lays great stress on the importance of making use of the freshly ground powder. In catarrhal cases I have found distinct benefit from the use of the *perles* of copaiba. None of the various drugs just enumerated, however, can legitimately lay claim to anything like a certain and specific action.

(3.) The *general antiseptics* include iron, chlorate of potash, carbolic acid, and salicylic acid with its compounds.[6] The value of iron has already been explained. Chlorate of potash, so useful in many affections of the throat and mouth, has also been largely used in diphtheria. Isambert [7] and Seeligmuller [8] have carefully studied the effects of this drug, and the general weight of evidence is very much in its favor. Ten to twenty grains may be given every two or three hours. I have not employed carbolic acid myself as an internal remedy, but the sulpho-carbolates, as recommended by Dr. Sansom,[9] have often proved of service in my hands, in the *secondary* poisoning of diphtheria. In the *primary* septicæmia, these remedies have appeared to me quite useless. Five grains of the sulpho-carbolate of soda in a little water may be given to a child of two

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[1] Memoirs on Diphtheria, from the writings of Bretonneau, Guersant, Trousseau, Bouchut, Empis, and Daviot. Selected and translated by Robert Hunter Semple, M.D., London, 1859, pp. 77–93.

[2] Ozanam: Comptes Rendus de l'Académie dês Sciences, 1856.

[3] Trait. de l'Ang. Couen. par le Baume de Cop. et le Poivre Cub., Paris, 1866.

[4] Dict. de Méd. et de Chir. Prat., t. x. p. 361.

[5] American Journal of Med. Science, 1876, p. 30 et seq.

[6] The sulphites introduced by Polli (Brit. Med. Journ., vol. ii. p. 441, 1867) have been strongly recommended by Giacchi and Ferrini (whose papers are referred to in the body of the article), but I have not tried them myself.

[7] Études Chim. sur l'emploi du Chlor. de Potasse dans les Aff. Couenneuses, Paris, 1856.

[8] L'Union Médicale, 9 juillet. 1878.

[9] The Antiseptic Treatment, London, 1871.

years every three or four hours. Salicylic acid has been strongly recommended by Fontheim,[1] and I have used it myself in three cases with apparent advantage. The following is the formula which I have employed: ℞. Acid. salicylic ʒ iss.; spirit. rect. ℥ iiss.; aquam distill. ad ℥ vj. M. Ft. solutio. One to two teaspoonfuls of this solution may be given every three hours. Great success is claimed by Dr. Hanow,[2] of Erlangen, for this remedy administered internally in half-grain doses every hour ; but these observations require confirmation. The salicylates of soda and potash have also been strongly recommended. I have given the former remedy in two cases, but in both instances the disease was too far advanced for benefit to result. Salicylate of soda and salicylic acid have been recently found useless by Drs. Cadet de Gassecourt and Bergeron respectively.[3]

(4.) The use of *expectorants* has long been more or less in vogue. The principal remedies of this kind which have been found useful are senega, carbonate of ammonia, and the balsams. Senega was recommended as an expectorant by Dr. Archer[4] nearly one hundred years ago. It has since been frequently employed in this country, and is highly esteemed by Dr. West.[5] A dessert-spoonful of the officinal infusion, sweetened with a little syrup, should be given every two hours, but the effect of the remedy should be watched, and the quantity reduced if any vomiting occur. Carbonate of ammonia (two or three grains) may be given with the senega, or it may be administered in water. The balsams of copaiba and cubebs, though placed under the list of alleged specifics, probably act in a great measure as expectorants.

Local Treatment.—This has varied greatly at different times, and there still exists considerable divergence of opinion as to which method is most appropriate. Caustics and astringents, solvents and antiseptics, heat and cold, have all been in favor at different times and with different observers.

The use of *caustics* has, perhaps, been more general than that of any other class of local application. Bretonneau[6] strongly recommended a mixture of hydrochloric acid and honey, in the proportion of one part of the former to three of the latter, as a means of checking the local exudation. The caustic was to be applied only once in twenty-four or thirty hours, and its effects were to be carefully watched. Subsequent experience has shown that besides being attended with very considerable pain, the use of strong hydrochloric acid has no effect in controlling the spread of false membrane. The use of a solution of nitrate of silver, and even of the solid stick, at one time met with considerable support, and has been recommended by Bretonneau, Guersant, Bouchut, and Trousseau,[7] but it is being gradually abandoned by those who have had experience of recent epidemics. The same remark is true of sulphate of copper and the acid nitrate of mercury, both of which have been recommended for the local treatment of diphtheria. In fact, the profession has given up the use of caustics altogether, being convinced that they rather aggravate, than check, the local process.

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[1] Journal für Praktische Chemie, 1875, vol. ii. p. 57.
[2] Mediz. Neuigk., Erlangen, May, 1875.
[3] L'Union Médicale, 9 juillet, 1878.
[4] Op. cit.
[5] Diseases of Infancy and Childhood. Sixth edition, London, 1874.
[6] Memoirs on Diphtheria (New Syd. Soc. Trans.), London, 1859.
[7] Ibid.

Various *astringents*, such as tannic acid, powdered alum, or perchloride of iron, have been used for many years, and still are largely employed. Tannic acid and alum are most conveniently administered by insufflation. Their effect is increased, as Dr. Loiseau [1] has pointed out, by using them alternately. Half a grain of tannin with half a grain of starch will be found the most convenient strength, whilst alum may be employed in the proportion of three-quarters of a grain of the salt to a quarter of a grain of starch. Insufflations are recommended to be used (by those who believe in their beneficial action) at least every hour or two. Perchloride of iron is best employed in the form of the tincture ; it should be freely applied every two or three hours. The disease is sometimes checked by this class of remedies, but on the other hand it sometimes irritates the throat—especially if there is much hyperæmia—and frequently increases the nausea and dislike to food which are so common. I now seldom use these drugs, with the exception of iron, which, when employed as a constitutional remedy, also acts topically.

Local agents which act as *solvents* have been introduced in modern times in diphtheria, with the view of getting rid of the false membrane without violence. The chief of these are : lime water, solution of caustic potash, chlorate of potash, and lactic acid. Added to pieces of detached membrane in a test-tube, each of these substances has certainly the power of dissolving them ; and whilst the false membrane is in contact with the living tissues, they have a similar, though less active, effect. Lime water has been particularly recommended by Steiner,[2] and is certainly useful when the false membrane is not very thick. Sanné [3] has recently suggested a saccharate of lime, which has the advantage of being a more stable compound than lime water. These preparations of lime can be applied either in the form of sprays or by means of a camel's-hair pencil. Liquor potassæ (one part of the liquor to four parts of water) can also be used in the same way. Of all the solvents, however, lactic acid is the most reliable. I generally apply it freely with a brush, or by means of a piece of lint attached to a wooden rod; the latter instrument permits of very free application. I have never met with the inconvenient results from the use of lactic acid which Küchenmeister [4] has described—viz., ulceration of the mucous membrane of the lips and mouth.

In most cases of diphtheria *antiseptics* are very useful. The best antiseptics are carbolic acid, permanganate of potash, chlorinated soda, glycerine of borax, chlorate of potash, and hydrate of chloral. Carbolic acid may be applied in solution (gr. iii. to ℥ j.), or in the form of Glycerinum Acidi Carbolici, B.P.,[5] or the Vapor Acidi Carbolici of the Throat Hospital Pharmacopœia may be used. Dr. Massei [6] specially recommends the use of the alcoholized carbolic acid, the carbolic acid being in proportion to the alcohol, as 1 to 3, or 1 to 5, according to the severity of the local exudation. Permanganate of potash is most serviceable when employed at the strength of gr. v. to ℥ j. The best formula for chlorinated soda is: Liquor sodæ chloratæ ℥ iv., aquæ ℥ x. Chlorate of potash

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[1] Gazette Médicale de Paris, 1862.

[2] Zur Therapie der Diphtherie : Jahrbuch für Kinderheilkunde, 1870.

[3] Op. cit. p. 429.

[4] Die Behandlung der Diphth. Angina durch Zertäubte Milchsäure, Dresden, 1870.

[5] Dr. Sansom has, however, shown that the antiseptic qualities of carbolic acid are greatly diminished by the addition of glycerine (Op. cit. p. 20 et seq.).

[6] Op. cit. p. 43.

may be given in almost any strength, though gr. xx. to ℥ j. is generally found sufficient. Hydrate of chloral has also been found very serviceable by several practitioners. It was first recommended by Dr. Accetella,[1] and subsequently by Dr. Ferrini,[2] of Tunis, and has since been highly extolled by Dr. Cæsare Ciattagli,[3] of Rome, and Dr. Massei,[4] of Naples. In this country it has been employed with great success during the last two years by Mr. Hughes Hemming, of Kimbolton, to whom I am indebted for its recommendation. Mr. Hemming uses the syrup of chloral (gr. xxv. ad ʒ j.), and directs that it should be employed every hour or two. It does not, as a rule, cause any pain, and the nurse can be easily taught to apply it. Mr. Hemming observes that, "whilst it rapidly gets rid of the fetor, it is beautiful to see the membrane loosen and come away, leaving a healthy surface underneath." This remedy has also been very successfully used by Mr. Charles Hemming, of Bishop's Waltham. One of the solutions above mentioned should be perseveringly employed in all cases of diphtheria where there is much false membrane. The antiseptic may be used either as a gargle or a spray; or the patient's mouth may be washed out with it by the attendant. In this way the horrible fetor of the breath, which is so common in diphtheria, will be prevented. It must not, however, be expected that the use of antiseptic solutions will have any restraining influence on the exudative process, though it may, to some extent, destroy the parasitic fungi so frequently present in the exudation. There is also a class of remedies which, though not strictly speaking antiseptic, still, by exclusion of air from the false membrane, appears to have antiseptic influence. These are, in fact, *varnishes*, and consist of gummy matters dissolved in a fluid which evaporates quickly. I have tried gum benzoin, gum tolu, mastich, and resin. These substances can be dissolved in rectified spirits, or in ether, or a tincture of the gum or resin may be mixed with ether. On the whole I prefer the ethereal solutions (1 in 5), and tolu is most pleasant to the patient, and, lasting longest as a varnish, has to be least frequently reapplied. The surface of the false membrane should be dried with blotting-paper[5] before the application is made.

There yet remain two local applications to be considered, viz., ice and steam.

In many cases the patient will derive great comfort from frequently taking a piece of *ice* into his mouth. The annoying dryness and heat of the throat, as well as the dysphagia, will be thereby materially alleviated, and the inflammation sometimes arrested. The application of ice to the neck in a bladder or ice-bag is sometimes agreeable, and probably generally beneficial. The use of ice is especially indicated in the first stage of the disease, particularly in those cases where there is much inflammatory tumefaction.

On the other hand, heat is a very useful agent when the false membranes have attained any considerable degree of thickness. Hot fomentations, applied externally to the throat, are often found to relieve the pain in a remarkable way, while the use of *steam* inhalations appears to exer-

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[1] Campania Medica, No. 12, 1873.

[2] Storia Clinica della Difterite osservata nella Città di Tunisi negli anni 1872–73. (Lo Sperimentale, Luglio e Settembre, 1874.)

[3] Gazzetta Medicale de Roma, Maggio, 1876.

[4] Op. cit.

[5] For holding the blotting-paper a miniature paper-clip, which can be fixed at different angles, is sold by Messrs. Mayer & Meltzer, 71 Great Portland Street.

cise an extremely favorable influence on the local process. As a vehicle for conveying a volatile medicament, steam has been recommended by many physicians, but as a remedy in itself for diphtheria it was first suggested by Dr. Prosser James.[1] The theory on which it is now used, however, is due to Oertel,[2] who has earnestly advocated the employment of steam on scientific grounds. When it is found impossible to check the formation of lymph by the use of local remedies, the rational treatment is to convert, as far as we can, the inflammatory into a suppurative process. Such a transition invariably takes place before the return of normal conditions, and to promote this transition is equivalent to hastening the restoration of health. Oertel has found that the internal use of moist warmth facilitates the occurrence of suppuration more than any other agent, and he recommends repeated inhalations of hot vapor. He has observed that at the end of from twelve to eighteen hours, during which the inhalation has been practised hourly or half-hourly for ten or fifteen minutes each time, the margins of the diphtheritic deposits, which previously passed imperceptibly into the surrounding tissue, become more sharply defined, and contrast strikingly with the intensely reddened mucous membrane. The patches, therefore, at first sight seem enlarged. Besides this, the operation of the hot vapor has been to induce a considerable excretion of pus corpuscles. If the inhalations be continued, the false membranes will be seen to become gradually thicker and raised up from the mucous membrane. At the same time they change in color, and their surface becomes wrinkled and uneven. After some days they are completely detached, and the mucous membrane is healthy, except for a variable degree of catarrhal inflammation. The inhalations may be made to serve another purpose, viz., that of cleansing and disinfecting the mouth, and with this object the Vapor Acidi Carbolici, or Vapor Pini Sylvestris (Throat Hosp. Phar.) may be used.

As young children cannot generally be induced to inhale the steam from an inhaler, "a croup-tent" should be erected over the cot for this purpose. An excellent portable apparatus[3] has been made for me by Messrs. Mayer. When the parts of the tent are put together, and a blanket thrown over it, it represents, on a small scale, the upper part of an old fashioned four-post bed (with the curtains drawn) such as is still common in the country.

The tent method of administering inhalations has been in vogue at the Children's Hospital for many years.[4] The steam-kettle[5] should then be placed near the tent, and steam passed within it.

The detachment of the false membranes, which has by some been advocated as a preparatory step to the application of remedies, cannot be recommended, except in cases where it may be necessary for the relief of urgent dyspnœa, or where putrefying membrane is lying loose in the

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[1] Sore Throat, 1861, p. 39.

[2] Ziemssen's Cyclopædia, vol. i. art. Diphtheria, p. 675.

[3] The "portable croup-tent" consists of eight metal rods. Two of these representing the length of the tent are four feet long, and two representing the width are two feet six inches long. The four supports are two feet four inches in height. The eight pieces screw together, and when separated can easily be carried in the hand. A special cloth or blanket, sold with the framework, completes the apparatus. The croup-tent is exceedingly useful, not only in cases of diphtheria and true croup, but also in laryngitis stridulosa, for saturating the atmosphere with the fumes of nitre and stramonium.

[4] Jenner: Op. cit. p. 83.

[5] An excellent steam-kettle is sold by Messrs. Allen, of Marylebone Lane.

throat. As a rule, the false membrane, when thus removed, rapidly reappears, and often with increased activity and over a wider area.

The above are the modes of treatment and kinds of remedies which are suitable in different forms of diphtheria. Many others might have been enumerated. As in the case of all diseases which are very fatal, a vast multitude of remedies have been most enthusiastically recommended, but I have referred to those only which I have myself tried.[1] It will perhaps give a more precise idea of the management of the disease if we suppose a certain typical case before us, and go through the various phases of treatment that may be required:

A child is attacked with a sore throat during an epidemic of diphtheria, and an examination of the fauces shows that the disease has already commenced, thin patches of false membrane being present. The little patient should at once be put to bed in a large, well-ventilated room, and should be made to suck ice constantly, whilst a bladder of ice should be applied to the neck. A simple but highly nourishing diet of beef-tea, eggs, etc., should be ordered, and stimulants as a rule be given from the very commencement. If there be evidence of primary blood-poisoning, twenty to thirty drops of the tincture of perchloride of iron and the same quantity of glycerine, and five to ten grains of chlorate of potash, in half an ounce of water, should be administered every three hours; if, on the other hand, the catarrhal symptoms be very marked, the balsamic treatment should be tried, and a capsule or *perle* of copaiba containing four minims of the balsam should be given every four or six hours. Local solvents should now be employed, and the throat should be sprayed every two or three hours with lactic acid solution, or, if the child will not allow this to be done, the pharynx must be forcibly swabbed with this remedy, or the syrup of hydrate of chloral may be applied in the manner already advised. If, in spite of this treatment, the disease advances, and the false membrane becomes thick and abundant, it should be painted with an ethereal solution of tolu (1 in 5), the surface of the false membrane being first dried with blotting-paper. This application, if thoroughly made, need not be applied more than once, or at the most twice, a day. Ice should now be given up, and warm inhalations, made antiseptic from time to time, constantly employed, by means of the croup-tent, in order to bring about suppuration and cause the false membrane to separate by the normal pathological process. It is useless continuing the copaiba any longer, and the iron often appears to lose its effect. It is at this period that the sulpho-carbolates sometimes have a wonderfully beneficial effect, and at this stage also quinine, in large doses, may be given at the same time with advantage. If the disease extend to the larynx or nose, the appropriate treatment hereafter detailed should be pursued. The third stage being characterized in favorable cases by the natural tendency to the separation of false membrane, the hot inhalations must be industriously continued, whilst the patient's strength is kept up by the use of highly nutritive drinks and stimulants. Such is the plan of treatment that may be pursued in an ordinary case of diphtheria. Complications, of course, require special remedies, and the sequelæ need appropriate restorative measures.

The impaired innervation of the lungs, which proves fatal in so many cases of diphtheria, is difficult to cope with. The most reliable measures

[1] Bromine and sulphuret of potassium as general remedies, and chloral hydrate as a local antiseptic, are almost the only exceptions to this statement.

consist in the assiduous administration of food and stimulants. The inhalation of weak ammonia has been recommended to meet this condition.

During convalescence the patient must still be carefully watched. The weakness and anæmia are best treated by iron and other tonics, by cod-liver oil, and by residence at some bracing watering-place. These measures are also appropriate in cases of muscular paralysis, but they then require to be supplemented by other therapeutic measures, according to the special symptomatic indication. The slight palsy of the pharynx and soft palate, which is the commonest form of post-diphtherial paralysis, generally passes off in a few weeks without treatment. Where, however, there is marked loss of power of the pharynx, epiglottis, or œsophagus, so that the food is only swallowed with great difficulty, it may be necessary to feed by means of the œsophageal tube; indeed, this procedure may be absolutely necessary to prevent the patient dying from inanition. In less extreme cases the use of the feeding tube will serve to prevent the food from passing into the larynx, an accident which is likely to be followed by inflammation of the lungs, and is always attended with great danger to the life of the patient. Sometimes it is sufficient to feed the patient on thickened liquids (*see* page 86). When the paralysis is obstinate, and when it extends to the muscles of locomotion, the employment of electricity is indicated. Both the faradic and galvanic currents are useful, but they should be applied in a mild form. For the extremities, this treatment may be combined with friction and shampooing of the affected parts.

Prophylaxis.—Before concluding the treatment of diphtheria, it may be well to add a few words on its prophylaxis. When inspecting the patient's fauces, or cleaning or changing the tracheotomy tube, the practitioner should be very careful to prevent any of the morbid secretions from coming into contact with his lips or mouth, fatal results having followed the neglect of this precaution. Like precautions should also be impressed upon the attendants who have charge of a case of diphtheria. Orders should at the same time be given that no one but the attendants should enter the sick-chamber, except upon urgent necessity; and all linen, spittoons, or other articles which the patient may have used, should be carefully disinfected. By adhering strictly to these rules, it is generally possible to prevent the extension of the disease.

LARYNGO-TRACHEAL DIPHTHERIA, FORMERLY CALLED CROUP.

Latin Eq.—Angina trachealis.
French Eq.—Le Croup. Diphthérie Laryngée.
German Eq.—Häutige Bräune. Croup.
Italian Eq.—Il Croup ; il Crup. Difterite laryngea.

The term *croops*, or *croup*, has been used popularly in Scotland from an early period. The word "croops" was first employed by Dr. Patrick Blair in 1713, and "croup" by Dr. Home, a little more than a century ago. Since then it has been somewhat vaguely used, both by the public and the profession in all parts of the world, to describe a certain train of

laryngeal symptoms. The word is probably derived from the crowing breathing, which is such a frequent accompaniment of the disease it was intended to describe. It has many allies in other languages, the closest being the Dutch *Geroop*, a cry; but the following are doubtless all derived from the same root, viz., Icelandic, *Hrôpa ;* Anglo-Saxon, *Hreopan ;* Gothic, *Hropjan ;* Old German, *Hrof ;* Modern German, *Ruf ;* all words intended to represent the sound of the voice.[1] The Scotch word *Roup*—hoarseness, has the same derivation. On the other hand *croup* may be derived from the Gaelic *crup*, signifying a *contraction*, *i. e.*, contraction of the throat.

History (*The Relation of Croup to Diphtheria*).—Though the history of diphtheria has been already briefly sketched, it is necessary to make a few remarks to explain how a form of diphtheria came to be regarded as a distinct disease, and to point out how other laryngeal affections have been and still are—at least in this country—included under the name of croup. Until diphtheria appeared in England in 1858 the term "croup" was employed to describe an acute affection of the larynx, believed to be inflammatory and non-contagious, in which false membrane was present. The tendency of modern investigation, however, is to show that cases formerly described as typical examples of croup were in fact examples of isolated laryngeal diphtheria. French physicians, who since the time of Bretonneau had been more familiar with diphtheria than the profession in this country, almost universally regarded the two affections as identical. When the violent epidemic of diphtheria broke out in England, in the year 1858, it was natural that practitioners should fail to connect the epidemic affection with the typical croup (previously generally isolated or endemic) with which they were familiar. Although the antiphlogistic theory was on the wane, croup was still described in text-books as a disease requiring active and lowering remedies;[2] whilst it was soon perceived that diphtheria could only be combated by analeptic treatment. Hence from the very outset an artificial distinction was created in the minds of prectitioners.

Whilst the term croup had been strictly applied to the pellicular inflammation of the larynx, many laryngeal affections in which a shrill cough, or a crowing inspiration, was present, had been described as varieties of croup; and the terms "false croup," "spurious croup," "catarrhal croup" were in common use. These affections, which are still often mistaken for true croup (*see* Diagnosis), had still further warped the judgment of the profession as regards the true nature of laryngeal diphtheria. Near the termination of the great epidemic, 1858–62, in this country, the identity of the two affections was, however, advocated by the late Dr. Hillier,[3] and in my Jacksonian Prize Essay[4] (1863), I maintained the same view. The doctrine of identity has subsequently been urged with

[1] Edinburgh Monthly Medical Journal, February, 1856.—Observations on Croup, by Charles Wilson.

[2] Even Dr. Squire, in his able and comprehensive article published so lately as 1866 (Russell Reynolds's System of Medicine, vol. i. p. 234 et seq.), recommends, in certain cases, bloodletting to the extent of three or four ounces for a child of four or five years of age.

[3] Med. Times and Gaz., April 26, 1862.

[4] This essay is in the library of the Royal College of Surgeons, and an extract from it referring to the subject of diphtheria and croup was published in the Brit. Med. Journ., March 5, 1870.

great earnestness and ability by Dr. Semple,[1] and his writings must have exercised considerable influence in this country.[2]

The advocates of the duality theory have based their views (1) on the supposed pathological differences, and (2) on the alleged clinical differences.

(1.) The supposed pathological differences in the structure of the two kinds of false membrane were formerly put forward as matters of great importance. Virchow,[3] the originator of these hypothetical distinctions, though admitting that the diphtheritic exudation was very similar to that of croup, maintained that the former was poured out *into* the substance of the mucous membrane, while the latter was only a coagulation *upon* its surface. On this hypothesis he founded what was once esteemed a most important point in practical diagnosis. The diphtheritic membrane, he asserted, could not be removed without tearing away portions of the underlying tissues, and leaving a bleeding surface. The croupous pellicle, on the other hand, could be easily detached, and the denuded surface would be found quite healthy, with the exception, perhaps, of a variable degree of hyperæmia. Before long, Virchow found himself compelled to surrender this distinction, as it was found in practice that the two forms of exudation passed into each other by insensible gradations. He now changed his ground,[4] and promulgated the view that death (necrosis) of the subjacent tissues was the characteristic and essential feature of diphtheritic exudation. Practically, however, this distinction was found to be no more satisfactory than the former, for cases came under observation which clinically answered to croup, but in which there was distinct death of tissue. It was also pointed out that the difference in the degree of adhesion of the croupous and diphtheritic exudations *is due to the difference in the structure of the parts on which they are thrown out.* The false membrane is naturally more closely adherent in the pharynx, where the epithelial layers on which it is deposited are not marked off from the subjacent tissues by any definite homogeneous basement membrane. On the other hand, in the larynx and trachea the presence of the basement membrane favors the separation of the lymph. It has thus at length been generally admitted that there are no sufficient naked-eye appearances to distinguish the croupous from the diphtheritic exudation. Nor have microscopical observers met with any better success in their endeavors to differentiate the two diseases. Dr. E. Wagner,[5] who has done the best work in this direction, has openly declared that his preparations of croupous and diphtheritic membranes are very much alike. The diphtheritic deposit he describes as a transparent, homogeneous, lustrous network, the interspaces of which are, for the most part, filled with lymph and pus corpuscles, though some of them are void of contents. The

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[1] Croup and Diphtheria, London, 1872.

[2] Most physicians in this country who have had the opportunity of studying the disease in the wards and in the deadhouse now regard croup as a form of diphtheria. At an early period Dr. George Johnson (Brit. Med. Journ., Feb. 19, 1870) maintained the identity of croup and diphtheria; and later, our great clinical teacher, Sir William Jenner (Lancet, Jan. 2 and 16, 1875) gave in his adhesion to this doctrine. The renowned Traube, of Germany, had previously accepted the unity theory (Berlin: Klin. Wochenschrift, No. 31, 1872).

[3] Archiv, 1847, p. 253 et seq.

[4] Handbuch der Spec. Path. und. Therapie, 1854, vol. i. p. 292. See also Berl. kl. Wochenschrift, 1865, No. 2.

[5] Archiv. der Heilkunde, 1866, vii. p. 481.

croupous membrane consists of a close network of delicate threads, the meshes of which contain numerous elements resembling pus-cells. Wagner, however, differs from many other observers, holding that the network in both cases has its origin in a peculiar fibrinous degeneration of the epithelium, and not in the separation of a coagulable fluid from the blood. Rindfleisch [1] admits that the pathological process in "pharyngeal croup" is the same as that which takes place in "laryngeal croup," and thus gives in his adhesion to the views maintained in the present article; but in spite of their anatomical identity, he feels bound to oppose any clinical fusion of the two diseases.

It will be seen from a consideration of the above facts that the pathological differentiation of the phenomena must be abandoned. We hence come to

(2.) The clinical differences. The supposed differences are (*a*) The site of the disease; and (*b*) its manifestations.

(*a*) Diphtheria is said to be an affection of the pharynx occasionally spreading to the larynx, whilst croup, it is asserted, is essentially a disease of the larynx or trachea. The fact is, that croup is a disease which commonly commences in the pharynx, and only in about 10 or 12 per cent. of cases originates in the larynx or trachea. Difference of site, moreover, in a constitutional disease does not constitute a specific difference. Cancer is always cancer, whether the pharynx alone, or the larynx alone, is affected, or whether the two parts are attacked at the same time or consecutively, and rheumatism is still rheumatism, whether it affects the heart or the ankle.

(*b*) As regards the manifestations of the disease:

(1) croup is said to be a local disease, (2) to be a sthenic inflammation, in which (3) the lymphatic glands are not affected; and (4) in which there is no albuminuria, nor (5) paralysis; whilst

(1) diphtheria is a constitutional disease, (2) of adynamic type, in which (3) the cervical glands are inflamed, and (4) in which there is no albuminuria (5) nor paralysis.

To discuss these briefly:

(1) It is true that in croup the general symptoms are not so severe as when the membrane is thrown out on an extensive portion of the pharynx. This fact admits of ready explanation, on the view that the septic symptoms are in part secondary to the local processes. For whilst the lymphatics of the mucous membrane of the soft palate, of the tonsils, and of the back of the pharynx have very free communications with the numerous glands below the angle of the jaw, the absorbent vessels of the mucous membrane of the larynx and trachea, are conveyed only to the solitary gland just below the greater horn of the hyoid bone, and the small gland at the side of the trachea.[2] There is, therefore, much less liability to general infection when the local process has seized only on the latter parts. When the primary septic poisoning is powerful the constitutional symptoms are, however, as marked in so-called croup as in diphtheria.

(2) Cases of sthenic croup are very rarely met with, and the same remark applies to diphtheria. On the other hand, there are medical men who assert that bleeding can be employed in diphtheria with success.[3]

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[1] Lehrbuch der Pathologischen Gewebelehre, Third edition, pp. 311-12.

[2] Luschka: Der Schlundkopf des Menschen, Tübingen, 1871, p. 156.

[3] Courier Médical, Sept. 7, 1878. Dr. Simorre reports fifty-three cases of diphtheria treated by bleeding! All the patients recovered—most of them in twenty-four hours.

Hence distinctions based on differences of type in the two diseases can have no weight.

(3) The cervical glands are not often affected in croup, because the mucous membrane of the larynx has no communication with the superficial cervical glands; on the other hand, as stated above, there is an elaborate connection between the pharynx and the lymphatic glands.

[In cancer of the pharynx also the cervical glands are always enlarged, whilst in cancer of the larynx the glands are seldom at all affected.]

(4) In croup albuminuria is often present.

(5) Paralysis is rare in croup, because nearly all the cases terminate fatally, but it is occasionally met with in those that survive.

I have entered into these details because details must always have a certain amount of significance; but it is more satisfactory to look at the question from a broad and philosophical point of view. Classifications are, after all, mere arbitrary arrangements by which knowledge may be placed in an accessible form for further use. The oldest classifications are purely symptomatic. When anatomy came to be mastered we had an anatomical basis for classification, and we are still obliged to make a considerable use of this system: but, as medical science progresses, the disposition is to track disease to its origin, and seek out its hidden causes. Hence we see arising at the present day an etiological classification. The *cause* of disease, when it can be discovered, is now regarded as the essence of its specific nature. The ordinary inflammation of mucous membranes is attended with engorgement of the tissues, and the formation of pus on the surface; under the influence, however, of a certain poisonous contagium the inflammation, instead of being attended with the formation of pus, leads to the exudation of layers of lymph, which become adherent to the free surface of the mucous membrane. This disease is called "diphtheria," and whether the lymph is deposited on the mucous membrane of the pharynx, or larynx, or trachea, or bronchial tubes, or any other mucous membrane, or on a wounded surface, the disease is still "diphtheria." To suppose that there are two kinds of pellicular inflammation of the larynx, one in which the cause is the diphtheritic poison, and the other in which the cause is some other undiscovered influence, is totally opposed to all probabilities.

Etiology.—This has already been discussed under diphtheria.

Symptoms.—The disease develops in three different ways. It may originate in the larynx. This is *typical croup*, and probably does not occur in more than 10 or 12 per cent. of cases.[1] Most commonly it commences in the pharynx, and extends downward, constituting *descending croup.* Occasionally, but very rarely, it commences in the bronchial tubes or trachea, and ascends into the larynx. This is *ascending croup.* If, as is commonly the case, the disease commences in the pharynx, the practitioner will be constantly on the watch to note the first invasion of the larynx, but in typical croup, or primary laryngeal diphtheria, it is otherwise, and the symptoms of croup have been conveniently divided into three stages.

The first stage is often preceded by slight catarrh. So insidious is the invasion of the disease that the serious character of the child's illness is

[1] See Sanné: Op. cit. p. 195. Sanné gives 142 cases out of 1,172. Compare also Simon: Nouveau Dict. de Méd. et de Chir. Prat.

often quite unsuspected. The little patient is noticed to be languid and feverish, he is thirsty, and refuses food, and at the same time there is slight hoarseness, which the nurse attributes to an ordinary cold, until her apprehensions are aroused by a frequent, short, dry, shrill cough. The voice, which was at first only a little harsh, very quickly loses its resonant character and becomes a whisper. On examining the chest, both the inspiratory and expiratory sounds are found to be prolonged, and the normal respiratory murmur is lost in the laryngeal stridor which occurs in inspiration. The supraclavicular spaces are usually somewhat more depressed during inspiration than in the condition of health, and the slight difficulty of breathing which is present is more marked during sleep. The pulse now becomes considerably increased in frequency, and the febrile symptoms generally more pronounced. If a laryngoscopic examination can be accomplished, the mucous membrane of the larynx is seen to be of a bright red color, and when the disease has existed for a few hours some thin patches of false membrane may be perceived on the mucous membrane of the larynx. The usually pendent position of the epiglottis in children often prevents a satisfactory examination even in those of tractable disposition; but the timidity of early life is in itself often sufficient to render the employment of the laryngoscope impossible. It is most important at this stage of the disease to make a very careful examination of the sputa. Children very often do not expectorate at all, but anything that is brought up must be put into a glass vessel and gently shaken with a little pure water. The mucus dissolves, and flocculi or small shreds of false membrane, if present, become visible.

The second stage is characterized by increasing dyspnœa, and by the attacks of suffocation which suddenly supervene from time to time. When the attack comes on the child is generally found sitting up in bed, with red and swollen face, and an anxious, terrified look. The nostrils are rapidly working, inspiration is hurried and "croupy," and is evidently performed with the greatest difficulty, all the auxiliary muscles of inspiration being called into play. The voice is almost inaudible, and there is a constant hoarse and stifled cough, without expectoration. The attack generally lasts three or four minutes, and the patient subsides into a heavy sleep which often continues for several hours. Sometimes unmistakable pieces of membrane are thrown up with the cough, a phenomenon which is often most important as a means of diagnosis, as in many children suffering from laryngeal diphtheria there are no patches of exudation to be detected on a casual inspection of the fauces. It is only on careful and persevering examination with the laryngoscope in cases favorable for examination that the membrane, which is the source of all the trouble, can sometimes be recognized adhering to, or perhaps lying loose in the chink of the glottis, and obstructing the passage of air. Occasionally the vomiting, which is induced by the constant fits of coughing, or by the administration of emetics, may lead to the separation and ejection of large pieces of membrane, in which case the urgent symptoms of dyspnœa are often most strikingly relieved. The mode in which separation takes place is exactly the same in the larynx and trachea as in the pharyngeal region; the process, however, is rendered easier by the arrangement of the mucous membrane, which, in the trachea and in the lower parts of the larynx is separated from the submucous tissues by a distinct basement membrane. But the improvement due to the expulsion of the concretions is generally only temporary; exudation again collects, and the symptoms return in greater intensity than before. At this stage of the disease the

pulse is very rapid, and generally irregular. The little patient is exhausted and is constantly bathed in sweat.

The third stage now supervenes. As the disease advances the suffocation becomes more urgent, and there is *no remission between the attacks, the dyspnœa being constant*, though fearfully aggravated every few minutes. The lips assume a livid color, and the nails become blue. The sternum and the intercostal spaces are forcibly drawn inward during each effort at inspiration, whilst the agony of impending suffocation is most distressing to witness. The child throws his arms wildly about, or clutches his throat to tear away, as it were, the obstruction, or he thrusts his fingers into his mouth to seize the offending substance. The symptoms of fever are intensified, the thirst is urgent, the tongue thickly furred, and the pulse quicker but weaker. The little patient dies in an attack of dyspnœa or soon succumbs to gradually increasing coma, to syncope, or exhaustion.

Diagnosis.—In children it is sometimes very difficult to distinguish *catarrhal laryngitis*, of a severe form, from croup. Indeed in the early stages it is often impossible to differentiate the two affections. In young children, from the small size of the larynx, and the great tendency to reflex irritation, slight inflammation of the larynx quickly gives rise to spasm, and produces stridulous breathing, *laryngitis stridulosa*, as it is technically called. When, however, the disease is fully developed, the two affections are easily distinguished, for whilst catarrhal laryngitis nearly always ends in recovery, in diphtheria the prospect of a fatal termination is soon apparent. Croup very often commences at night, but catarrhal laryngitis almost invariably comes on at that time; hence we have in the time at which the disease first manifests itself a possible diagnostic sign. It has already been pointed out that the laryngoscope cannot ften be successfully used in young children, but the expectoration must be examined in the way already described, and false membrane, if present, will always be detected.

Further, there is a pure neurosis, a spasmodic action of the adductors of the vocal cords, giving rise to *laryngismus stridulus*, which has been called "spurious croup," "false croup," and "nervous croup," with which true croup is sometimes confounded. This disease very frequently comes whilst the mother is suckling, or dandling the child. Carpo-pedal contractions also occur in marked cases of laryngismus, but above all there is *the absolute intermission* of all dyspnœa between the paroxysms; whilst in true croup, when fully established, slight dyspnœa is always present between the attacks of suffocation. Many fatal cases of laryngismus, however, no doubt lose their qualitative affix and appear in the Mortality Returns as simple "croup."[1]

Pathology.—The false membrane does not differ essentially from that described in connection with the pharyngeal form of the disease. The membranous exudation is more frequently found on the epiglottis and the ary-epiglottic folds than on the lower portions of the larynx, but occasionally it invests the whole of the lining membrane of the larynx, extends throughout the ventricles, and passes along the trachea to the smallest ramifications of the bronchi. It rarely happens that the lymph is so abundant as to completely occlude the larynx, and in many fatal cases only a very thin, transparent membrane is found. The dyspnœa in

[1] The above considerations tend to show that the substantive use of the word "croup" is altogether objectionable.

croup is primarily due to the inflammatory tumefaction and plastic exudation, which, however, soon gives rise to spasm of the adductors. The muscles are infiltrated with serum, but there is no paralysis of the abductors, nor atrophy of their structure.[1] The lymph is also more closely adherent in the supra-glottic than in the sub-glottic region. On removing the lymph the mucous membrane is generally almost normal below the level of the vocal cords, but above that line it is often swollen and inflamed, and sometimes ulcerated. It has already been stated that the membrane which forms in the trachea can be much more easily detached than that which is found in the pharynx. There is nothing special as regards the false membrane in the trachea, which is generally more adherent in the upper than in the lower portion of the tube.

Prognosis.—The prognosis is most unfavorable. Probably not more than ten per cent. of the patients recover under suitable treatment without tracheotomy. In this country tracheotomy is, comparatively, so little practised in croup—in proportion to the number of cases—that nearly all the remainder prove fatal. If, however, the remaining 90 per cent. were tracheotomized, 66 per cent. might recover according to the most favorable statistics (see note 3, page 184), or, according to an average, based on 4,663 operated on in the Children's Hospitals of Paris, 23.91 per cent. Accepting the latter figures, out of 100 cases of undoubted croup we might expect that 68.49 would terminate fatally, and 31.51 recover—10 without tracheotomy and 21·51 (*i. e.*, 23.91 per cent.) after the operation. If the trachea were not opened in the proper proportion of cases the fatality would, of course, be proportionately greater ; whilst if the operation were performed earlier than is commonly the case, the mortality would probably be considerably less. The fatal termination may be expected in the first three or four days, certainly within the first week.

Treatment: First Stage.—The child should be placed in a warm, well-ventilated room, an ice-bag should be applied to the neck, and ice constantly sucked. Spray inhalations of lactic acid (℥ xx. ad ℥ j.) should be employed. The inhalations should be given at least every hour, and continued for five minutes at a time. In *the second stage*, or as soon as it is believed that false membrane has formed, emetics must be employed. A number of instances are recorded in which children have been saved from imminent asphyxia by the spontaneous expulsion of false membrane, and this natural mode of cure has sometimes been happily imitated by the administration of emetics. According to Valleix,[2] in thirty-one cases so treated, fifteen recovered, whilst of twenty-two in which this class of remedies was neglected, only one cure resulted. Trousseau concurs with the statements of Valleix. In many cases, however, the relief is merely temporary, the membranes quickly reforming in the larynx, and the dangerous symptoms returning with increased severity. Moreover, the practice is not altogether unattended by danger, for, the tracheal membrane may be forced up by the act of vomiting in such a way as to entirely obstruct the passage of air. This risk must be incurred, though valuable time should never be wasted on the use of emetics, when the only alternative is the performance of tracheotomy. Tickling the fauces will occasionally be sufficient to excite the desired action, but as a rule, it is necessary to resort to drugs. Cardiac depression is so common

[1] See an interesting case recently published by Dr. Baginsky : Central. Zeitung für Kinderheilkunde, October 1, 1878.

[2] Guide du Méd. Prat., t. i., Art. Diphthérite.

an accompaniment of diphtheria that it is unwise to employ any emetic by which it is likely to be increased. Tartar emetic must, therefore, be especially avoided. Strange as it may seem, this drug has in times past been very widely employed in diphtheria. Trousseau,[1] indeed, strongly condemned its use, terming it the most dangerous of all emetics. But Bouchut,[2] as late as 1859, published three cases in which he attributed a successful issue to the energetic employment of tartar emetic. His example should not be followed, especially as we have at our command emetics which are not less certain in their action than antimony. Should the practitioner distrust the efficacy of ipecacuanha, it is quite open to him to add from fifteen to twenty grains of sulphate of zinc. If the administration of these agents is not quickly followed by vomiting and the expulsion of the membrane it is useless to repeat them, and even where the breathing has once been temporarily relieved by their use, it is very questionable whether they should be again employed. In no case should the physician place too much reliance upon them.

When it is judged that there is false membrane loose in the larynx, the removal of the membrane by direct mechanical means should be attempted. The best instrument used for this purpose is a brush attached to a piece of soft aluminium wire. Instead of the common laryngeal brush I use one made of squirrel's tail. *The hairs cover the sides of the laryngeal portion of the brush*, and are directed upward. As the laryngoscope cannot generally be used, the brush, guided by the forefinger of the left hand, should be carried down into the interior of the larynx. The windpipe can generally be freed from exudation by to-and-fro movements combined with a certain amount of rotation. I have several times employed this brush with marked advantage. Even if the practitioner is successful, however, in detaching portions of membrane, fresh exudation often recurs.

I must here briefly refer to the subject of catheterism and "tubage" of the larynx. Catheterism was first recommended by Loiseau,[3] as a means of removing false membrane and introducing remedies into the windpipe. I have only to say that the false membrane can be much more easily removed with a proper croup-brush, and that solutions or powders can be more readily applied with a common laryngeal brush or insufflator. "Tubage," introduced by Bouchut,[4] consists in the introduction of a small tube, from three-quarters of an inch to an inch in length, and leaving it in the larynx. It causes so much irritation that it cannot be retained, and its use has been quite given up.

It is at the close of the second stage of croup, when inhalations and emetics have failed, that tracheotomy is called for. Marked recession of the sternum and chest-walls is the indication for its performance. The credit of having been the first to establish this operation on a secure basis as a justifiable part of the treatment of croup is due to Bretonneau,[5] who published his first successful case in July, 1825. Ten years later Trousseau [6] reported that he had performed the operation thirty-six times with nine recoveries. From this time the position of the operation was secured, and it has since been performed many thousand times in France alone. Before his death, Trousseau [7] published a series of 466 cases in which the operation had been performed in the Children's Hospital in

[1] Trousseau: Op. cit vol. ii. p. 578.
[2] L'Union Médicale, April 5, 1859.
[3] Bull. de l'Acad. de Méd., 1857.
[4] Ibid., Sept., 1858.
[5] Bretonneau: Memoirs (New Syd. Soc.), p. 59.
[6] Trousseau: Ibid. p. 243.
[7] Trousseau: Rapport à l'Acad. de Méd: Bull. de l'Acad. de Méd., vol. xxiv. p. 112.

Paris, between the years 1849 and 1858. Of these, in spite of unfavorable surroundings, 126, or more than 1 in 4, recovered. Later statistics have given still more favorable results. In 1863, Fischer and Bricheteau[1] collected all the facts within their knowledge at the Hôpital des Enfants Malades, the Hôpital Sainte Eugénie, and in the city and the provinces, and the general results were as follows:—At the Hôpital des Enfants Malades the operation had been performed in 1,011 cases, and the proportion of recoveries was 1 in 4; at the Hôpital Sainte Eugénie the proportion was 1 in 6; while the facts collected from other sources, though confessedly incomplete, showed in Paris 1 cure to 2.6 cases, and 1 to 3.6 in the provinces. According to M. Sanné, however, who has published the most extensive statistics from the Paris hospitals, during recent years the proportion of recoveries after tracheotomy has been less favorable, especially at the Hôpital Sainte Eugénie, as will be seen from the appended tables[2] :—

HÔPITAL SAINTE EUGÉNIE.

Years.	Operations for Croup.				Proportion of cures.
	Discharged cured.	Dead.	Left uncured.	Total.	
1854	2	7	0	9	1 in 4.50
1855	4	9	0	13	1 " 3.25
1856	5	19	0	24	1 " 4.80
1857	5	24	1	30	1 " 6.00
1858	23	95	4	122	1 " 5.29
1859	17	88	4	109	1 " 6.41
1860	7	31	2	40	1 " 5.71
1861	16	45	3	64	1 " 4.00
1862	23	67	7	97	1 " 4.21
1863	35	68	3	106	1 " 3.02
1864	26	85	4	115	1 " 4.42
1865	44	87	6	137	1 " 3.11
1866	36	76	3	115	1 " 3.19
1867	29	63	4	96	1 " 3.31
1868	31	101	3	135	1 " 4.35
1869	31	70	2	103	1 " 3.35
1870	42	85	4	131	1 " 3.11
1871	12	78	3	93	1 " 7.75
1872	39	138	10	187	1 " 4.79
1873	32	170	11	213	1 " 6.65
1874	23	132	7	162	1 " 7.04
1875	27	175	9	211	1 " 6.48
	509	1,713	90	2,312	1 in 4.54

[1] Nouveau Dictionnaire de Médecine et Chirurgie, 1869, vol. x. p. 368.

[2] The results at this hospital for the first nine months of 1876 were still more unfavorable, the proportion of cures being only 1 in 8.31. This steady increase in the mortality after tracheotomy is attributed by M. Moizard (Thèse de Paris, 1876, No. 493), partly to the progressive extension of the operation to more and more hopeless cases, and partly to the more malignant character of the disease in Paris during recent years.

HÔPITAL DES ENFANTS MALADES.

Years.	Operations for Croup.				Proportion of cures.
	Discharged cured.	Dead.	Left uncured.	Total.	
1851	14	17	0	31	1 in 2.21
1852	18	43	0	61	1 " 3.38
1853	9	52	0	61	1 " 6.77
1854	14	29	0	43	1 " 3.07
1855	12	34	0	46	1 " 3.83
1856	16	33	3	52	1 " 3.25
1857	16	54	0	70	1 " 4.37
1858	34	73	2	109	1 " 3.20
1859	41	115	4	160	1 " 3.90
1860	24	101	3	128	1 " 5.30
1861	29	72	1	102	1 " 3.49
1862	27	112	6	145	1 " 5.37
1863	46	86	10	142	1 " 3.08
1864	40	105	8	153	1 " 3.82
1865	40	86	4	130	1 " 3.25
1866	27	71	3	101	1 " 3.74
1867	15	57	4	76	1 " 5.06
1868	26	36	0	62	1 " 2.38
1869	12	54	0	66	1 " 5.50
1870	21	43	0	64	1 " 3.04
1871	16	27	0	43	1 " 2.67
1872	30	71	9	110	1 " 3.66
1873	26	79	2	107	1 " 4.11
1874	23	81	4	108	1 " 4.69
1875	38	130	13	181	1 " 4.76
	614	1,661	76	2,351	1 in 3.82

At the Hospital for Sick Children in the twelve years 1864 to 1876, sixty cases of croup and diphtheria were operated on. Of these thirteen, or 21.6 per cent., were successful. According to Krönlein's [1] recent statistics at the Hospital in Berlin the percentage of cures after the operation was 30.[2] This was the result of 567 operations performed between January 1, 1870, and July 30, 1876, in Professor Langenbeck's clinic. By selecting the best individual series of statistics, for the most part from private practice, Dr. Solis Cohen [3] has brought together 166 cases of tracheotomy in croup with 110 recoveries!

Considering the enormous mortality of laryngeal diphtheria, even the most unfavorable figures prove that in such cases tracheotomy is not only justifiable, but that it is a positive duty. The chief questions to be con-

[1] Langenbeck Archiv., Bd. xxi. hft. ii.

[2] See also Hüter: Laryngotomie und Tracheotomie, Pitha-Billroth's Chirurgie, vol. iii. part. i. Nro. 5, p. 26 et seq.

[3] Croup in its Relation to Tracheotomy, Philadelphia, 1874.

sidered in connection with the operation are what are the indications, and what is the best period for its performance?

The cases most favorable for the operation are those in which the symptoms of general infection are slight or absent, and the strength of the patient is unimpaired. It is where the patient has still some vigor, where the pulse is strong and regular, the powers of assimilation good, and the asphyxia, though very marked, is not yet too advanced, that tracheotomy becomes most imperative. In such cases there can be no doubt that the operation has saved, and doubtless will still save, many thousands of lives. It is now generally admitted that tracheotomy should be performed without delay, as soon as it has become clear that it is impossible to relieve the asphyxia by other means. It is clear that an early insertion of the canula gives the patient a much better chance of recovery than when there is a long delay; and it is owing to the disregard of this fact that tracheotomy in diphtheria has in some quarters acquired such an evil repute. For the description of the operation, and the precautions which must be taken in performing it, I must refer the reader to the article on Tracheotomy, but I would here call attention to the extreme importance of endeavoring, immediately after the operation, to draw out any loose false membrane, either with the croup-brush, or an aspirator accurately applied to the mouth of the canula. The after-treatment is very important, and the patient requires most assiduous attention for some days. The temperature and due moisture of the room must be carefully maintained, the tube must be constantly watched, and freed from secretions or pieces of ejected membrane, and the wound must receive daily attention. At the same time the administration of food and stimulants must be the subject of the greatest care and regularity, and the antiseptic sprays should be administered through the canula. The chief dangers to be feared in the after-treatment of tracheotomy are extension of the exudation into the bronchi, occlusion of the tube, and failure in the innervation of the lungs. The effects of extension of the membrane may in some cases be averted by removing the tube, and extracting fragments of lymph from the trachea with forceps, or with the croup-brush. Long strips of exudation, and in rare cases almost entire casts of the windpipe, have been removed in this way. Occlusion of the tube is only to be prevented by placing the patient under the charge of a trustworthy attendant, who will not fail in cases of emergency to remove the canula and free the passage.

In the third stage tracheotomy remains the only hope of saving the patient's life. If the operation has unfortunately not been performed in the second stage, the chance of success is very much diminished. The operation is not contra-indicated, however, even when the apnœa is extreme, and the patient is apparently on the point of suffocation, provided only that the heart's power is still good. In some cases the patient has been saved by it when literally at the last gasp. Such instances, however, are quite exceptional. Some authorities have maintained that even in quite hopeless cases, where the patient is dying from dyspnœa, tracheotomy should be performed with the view of promoting the euthanasia. It is true that death from syncope or gradual exhaustion is much less painful than death from apnœa, and it may be advisable to secure this substitution by a surgical operation. But it is not in these cases that tracheotomy finds its really valuable application. When it is found, on auscultation, that air enters one lung and does not penetrate the other, it is clear that the false membrane has extended down one bronchus, and

tracheotomy is then much less likely to be of any use. In the same way, if extensive pneumonia has supervened the operation is likely to be of little benefit. Where the patient is already dying of cardiac failure or exhaustion, it is of course in vain to attempt to save life by the surgical operation.

NASAL DIPHTHERIA.

In some epidemics of diphtheria the disease commences with nasal catarrh, and this phenomenon was so common in the epidemics witnessed by Bretonneau, that he regarded it as the common course of the disease. Further experience, however, has demonstrated that catarrh of the nose is far less usual than it was at one time supposed, and that true nasal diphtheria is generally due to the extension of the plastic inflammation from the pharynx. The disease commonly first shows its presence by an unhealthy brown ichorous discharge, which causes abrasion, and even ulceration, of the skin in the neighborhood of the nostrils. Soon afterward the parts are covered with false membrane which can be seen extending through the nose. At other times the false membranes do not reach the external orifice, but, on using the speculum, a few scattered deposits of lymph can be perceived on the mucous membrane of the septum or the turbinated bones. The false membrane, however, is generally most abundant at the posterior nasal orifices.

In this form of diphtheria it is especially necessary to endeavor to prevent the products of the disease from accumulating and putrefying in the nasal cavities, for experience has shown that, under such circumstances, they are extremely liable to be absorbed and to lead to secondary septic poisoning. It is all-important, therefore, to keep the passages as clear as possible, by the use of astringent or solvent liquids. With this object, weak solutions of alum, tannin, carbolic acid, permanganate of potash, or lactic acid, should be repeatedly syringed over the affected parts. If epistaxis occurs, as it frequently does in nasal diphtheria, an astringent snuff or lotion is usually sufficient to arrest it. Plugging the nares should, if possible, be avoided.[1]

THE THROAT AFFECTIONS OF THE ERUPTIVE FEVERS.[2]

(Scarlatina, Measles, and Small-Pox.)

Latin Eq.—Morbi gutturis inter exanthemata (Febrem rubram, Morbillos, Variolam).

French Eq.—Maladies de la gorge dans les fièvres éruptives (Scarlatine, Rougeole, Variole).

German Eq.—Die symptomatischen Halsaffectionen bei den acuten Exanthemen (Scharlachfieber, Masern, Blattern).

[1] The various features of diphtheria are discussed in slightly greater detail in my recent work, entitled, Diphtheria: its Nature and Treatment. Churchill, 1878.

[2] As the pharynx and larynx are so frequently affected together in the acute exanthemata, I have thought it better to treat all the local manifestations in this section.

Italian Eq.—Le malattie della gola negli esantemi (Febbre scarlatina, Rosolia, Vajuolo).

Definition.—Morbid phenomena manifested in the mucous membrane and subjacent structures of the pharynx and larynx during the course of scarlatina, measles, and small-pox.

Scarlet Fever.

The mucous membrane of the *pharynx* is generally affected in scarlatina, and in some cases the pharyngeal enanthem appears to constitute the only local expression of the disease. Although the skin eruption of this fever often comes out on the second day, that is, the day after chilliness, vomiting, and headache have occurred, in most cases soreness of the throat is the first symptom complained of.

In *Scarlatina Simplex* little or no redness can be seen on examination, and there is only slight aching or stiffness, which ceases in a day or two from the commencement of the attack.

In *Scarlatina Anginosa* great soreness of the throat is a marked feature of the disease. On inspecting the pharynx the whole of the mucous membrane is seen to be of a deep red or even violet hue, and as the fever develops considerable internal and external tumefaction of the tissues takes place. The tonsils, and the submaxillary and parotid glands, are implicated in the morbid process, and in many cases all the structures of the neck become the seat of a violent phlegmonous inflammation, terminating at one or more parts in abscess. At this stage of the malady, viz., the third or fourth day of the attack, the mucous membrane of the pharynx generally becomes covered with a quantity of whitish pultaceous exudation. The subjacent epithelium is often partially destroyed, giving rise to shallow abrasions; but deep ulceration is very seldom present. In some cases resolution takes place at this stage; the swelling becomes reduced, and the tissues soon regain their normal condition. In the worst instances, however, suppuration occurs in the cellular tissue or glands of the neck, and large abscesses form, which usually burst externally, near the angle of the jaw, though sometimes they burrow downward as far as the clavicle. After all the specific symptoms of the fever have disappeared, such cases frequently prove fatal from the exhaustion caused by copious and long-continued discharge of pus. During the progress of this form of scarlet fever the disease sometimes extends to the *larynx*, when the voice is modified, and, if the epiglottis is much inflamed, deglutition becomes difficult, and liquids regurgitate through the nose. Some difficulty of breathing may also be present, but as Trousseau[1] observes, "scarlatina does not like the larynx," and suffocation from œdema of the glottis is a rare issue of the complaint.

In *Scarlatina Maligna* the characteristic phenomenon is secondary diphtheria.[2] In these cases the pharyngeal lesion is more tardy in its appearance, and the patient often seems at first to suffer from a mild attack of the malady. About the ninth day, when the eruption has disappeared and the feverish symptoms have abated, the disease attacks

[1] Clin. Med. de l'Hôtel-Dieu. Paris, 1865, vol. i. p. 105.

[2] See Fuchs: Historische Untersuchungen über Angina Maligna und ihr Verhältniss zu Scharlachfieber und Croup, Würzburg, 1828.

the pharynx, and in a few hours swelling takes place in the glands at the angle of the jaw. The tonsils and fauces are covered with diphtheritic exudation, a fetid sanious discharge proceeds from the nares, and the breath becomes tainted with a foul odor. Occasionally the morbid process extends to the larynx, and this has been noticed to occur more frequently in some epidemics than in others. Gupp[1] described an epidemic in Würtemberg in which, in the greater number of cases, croupy symptoms appeared from the third to the fourth day of the illness; and in some cases death took place before the exanthem appeared. As in primary diphtheria, on separation of the lymph, ulceration of the mucous membrane is often found. A characteristic specimen of ulceration (No. 36, Series W.) is contained in the Museum of St. Thomas's Hospital. The larynx, which was taken from an adult patient who died of scarlatina, has a very thin layer of lymph covering the entire mucous membrane, and the right arytenoid cartilage is laid bare by a large ulcer. Gangrene not unfrequently attacks the pharynx, larynx, and œsophagus, the pulse becomes weak, the surface of the body is blanched and cold, collapse supervenes, and the patient dies in a state of coma.[2] In some cases large vessels are opened by the ulcerative process, and death occurs from hemorrhage. A somewhat rare complication of the malignant form of scarlet fever, "scarlatinal buboes," requires some mention. They are situated principally in the glands of the neck, which become suddenly inflamed about the tenth or twelfth day, and in five or six days a large abscess is formed. Sphacelus of the surrounding cellular tissue may take place, and Graves[3] and Trousseau[4] report cases in which the muscles of the neck were laid bare, and the carotids could be seen pulsating at the bottom of the wound.

Diagnosis.—The recognition of the scarlatinal nature of the angina is principally based on the existence of the skin eruption during some period of the illness. The suddenness of the attack, the intensity of the accompanying fever, the deep red or violet tinge of the pharynx, and the occurrence at the same time of an epidemic of scarlet fever, all tend to assist in the diagnosis; but when the pathognomonic exanthem is absent some uncertainty must often remain as to the true nature of the malady. In such cases the subsequent development of dropsy and albuminuria occasionally sets any doubt at rest.

Prognosis.—The local affection is itself often a cause of death, and as the throat manifestations of scarlet fever are the expression of the intensity of the general blood-poisoning, they furnish an important indication as regards the constitutional condition. In scarlatina simplex the local affection is unattended with danger. Scarlatina anginosa probably results in death in about one-fourth of the persons attacked, whilst in the diphtheritic form about half the patients die.[5]

Treatment.—Local measures are of but little use in the treatment of the anginæ of scarlet fever. Trousseau[6] advises the application of hydrochloric acid to the throat, when it presents a pultaceous or gangrenous aspect. The dilute acid has also been administered internally, on the supposition of its possessing a specific action against the general blood-poisoning. In severe cases a general tonic and analeptic treatment must be adopted, whilst emollient gargles, hot, soothing inhalations, and

[1] Rühle: Op. cit. p. 243.
[2] See Graves: Clinical Lectures on the Practice of Medicine. Lect. xxii. Dublin, 1848.
[3] Op. cit. vol. i. p. 345.
[4] Loc. cit. p. 107.
[5] Sanné: Op. cit. p. 179.
[6] Loc. cit.

warm poultices are the only local remedies that can be employed with advantage. The treatment of the plastic form of inflammation should be such as is recommended for primary diphtheria, viz., the internal use and local application of the persalts of iron, a highly nourishing diet, the free use of alcoholic stimulants well diluted, and the employment of antiseptic sprays and solutions. The practitioner must always bear in mind that tracheotomy may be necessary.

Measles.

The *pharyngeal affection* of measles is usually of slight importance, as in severe outbreaks of this fever the gravest lesions are manifested in the larynx, trachea, and bronchi. In many cases no eruption takes place on the mucous membrane of the throat, whilst in the great majority of instances, although more or less redness can be seen on inspection of the pharynx, the patient does not complain of any soreness of the throat. The enanthem appears at about the same period of the fever as the exanthem, *i. e.*, in the course of the third or fourth day. False membranes may become developed after the subsidence of the general pyrexia, and occasionally even gangrene of some portions of the pharyngeal tissues may occur.[1]

The laryngeal disease may be either a simple catarrh, or true diphtheria. The catarrhal form of laryngitis may occur before the exanthem, or a day or two after the rash has come out, but in some epidemics it develops when the eruption has almost disappeared.[2] It is more common than the croupy form of disease, and though occasionally the inflammation runs high, it is seldom of any importance. The principal symptom is obstinate hoarseness. In a number of Professor Hebra's patients in the General Hospital at Vienna, in different stages of measles, Dr. Stofella[3] found a highly injected condition of the mucous membrane of the larynx in almost all the cases which he examined laryngoscopically. "This variety of croup," observes Dr. West, "seldom begins until the eruption of measles is on the decline, or the process of desquamation has commenced. Its occurrence is most frequent from the third to the sixth day from the appearance of the eruption, but it oftener occurs at a later than at an earlier period."[4] Laryngeal diphtheria, or croup, is much more common than pharyngeal diphtheria. The prognosis is more unfavorable than in scarlatinal diphtheria, 80 per cent. of the cases terminating fatally.

Treatment.—No special treatment is required for the catarrhal affection, as spontaneous resolution takes place in seven or eight days. In the presence of false membrane, mortification or collapse, the same measures must be adopted as recommended in the articles on diphtheria, croup, and putrid sore throat.

Small-Pox.

From the third to the sixth day of the eruption of variola the *mucous membrane of the pharynx* often becomes the seat of a crop of pustules

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[1] See Barthez and Rilliet: Traité des Maladies des Enfants, Paris, 1853.
[2] Bohn: Königsberger Medizin. Jahrbücher, 1852.
[3] Wien. Medizin. Wochenschrift, Nos. 18, 19, 20, 1862.
[4] Op. cit. p. 448.

similar to those on the skin. In quantity they correspond, to some extent, to the abundance of the exanthem, and in severe cases they cause considerable inflammation and tumefaction in the throat, together with great pain in swallowing. Pustular sore throat, as Trousseau [1] remarks, is also often accompanied by ptyalism, whereas in scarlatina this symptom is almost always absent. Ulcerations of sufficient depth to lay bare the muscular tissues occasionally occur in the malignant forms of confluent small-pox.

The laryngeal affection may be a mild papular or pustular eruption of the mucous membrane, which causes little or no inconvenience, or it may be a diphtheritic process, which is often fatal. In the year 1863, through the courtesy of Mr. Marson, I was enabled to examine several patients in the Small-pox Hospital with the laryngoscope. In one patient laboring under severe purpuric small-pox, I found ecchymotic spots on the under surface of the epiglottis and on the mucous membrane over the arytenoid cartilages. In a convalescent case there was a distinct pustule on the edge of the epiglottis; in another instance, in which the entire body was covered with pustules, the larynx appeared perfectly healthy; and in another similar example there were no pustules, but there was marked congestion of the mucous membrane; in another instance the upper surface of the epiglottis was covered with pustules. Trousseau [2] mentions the circumstances of three cases that came under his own observation, where death took place from suffocation. "Three patients," he observes, "had arrived at the eleventh day of a variola, which up to that time had pursued a normal course. Suddenly they were seized by a frightful attack of suffocation, which carried them all off before sufficient time had elapsed for any one to come to their assistance. In one of these individuals traces were found at the autopsy of inflammatory lesions of the larynx and pustules of small-pox below the glottis." In another case [3] the post-mortem discovered œdema of the aryepiglottic folds, with an abscess as large as a pigeon's egg between the œsophagus and larynx. Rühle, who witnessed a bad epidemic of small-pox in Greifswald, in 1856–57, and who made no less than fifty-four post-mortem examinations, observes,[4] "Although I have seen here and there pustule-like elevations, I nevertheless consider the essential peculiarity of the laryngeal affection to be a croupous or diphtheritic inflammation." This author adds that as "out of the fifty-four cases there was not a single instance in which the larynx and windpipe were in a normal state, he cannot but attribute a certain proportion of the mortality to the laryngeal affection." Pathological examples of the diphtheritic complications of small-pox are to be found in the museums of St. Thomas's and St. Bartholomew's Hospitals and in other collections. In two instances I have known permanent paralysis of the adductor of a vocal cord follow small-pox; in both of these the larynx was affected at the time, and it is probable that the affection was of the diphtheritic character.

Treatment.—In the milder class of cases, emollient gargles and weak astringent applications are useful. Suffocative attacks, dependent on œdema, must be met by scarification of the larynx, and in the worst cases by tracheotomy. In the diphtheritic form of disease treatment is almost useless, but the local remedies elsewhere recommended for primary diphtheria should be adopted.

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[1] Loc. cit. p. 15 et seq.
[2] Ibid. p. 16.
[3] Ibid. p. 20.
[4] Op. cit. p. 247.

THE THROAT AFFECTIONS OF TYPHOID FEVER.

Latin Eq.—Morbi gutturis inter febrem entericam.
French Eq.—Maladies de la gorge de la fièvre typhoïde.
German Eq.—Halsaffectionen beim Abdominaltyphus.
Italian Eq.—Le malattie della gola nella febbre tifoide.

Definition.—The throat affections of typhoid fever are of two kinds—(*a*) a low type of inflammation of the mucous membrane of the pharynx or larynx, leading in the latter situation to deep ulceration; and (*b*) secondary diphtheria.

The *pharynx* is not invariably affected in enteric fever, the blood-poison more frequently provoking an attack of bronchitis or pneumonia. The mildest and most frequent form of pharyngeal lesion consists in a simple erythema of the mucous membrane of the mouth and fauces; and subjectively the affection occasions but little inconvenience beyond a dryness of the throat, and slight soreness in swallowing. The parts gradually regain their natural condition as the convalescence of the patient becomes established. Occasionally an herpetic eruption is seen on the mucous membrane of the pharynx and mouth, which is attended by considerable pain in deglutition. This affection, which is only an accidental complication, though more severe than the erythematous condition, like it also undergoes spontaneous resolution, without leaving any ill effects.

Secondary diphtheria is accompanied by the physical appearances and symptoms of the primary affection.[1] When this complication occurs in typhoid fever the prognosis is most unfavorable. Thus, out of six cases mentioned by Oulmont,[2] five terminated in death; whilst Peter[3] states that all the instances he has met with have proved fatal.

In *the larynx*, as in the pharynx, both the inflammatory and the diphtherial affections are met with. The inflammatory changes have, as Dr. Wilks[4] has pointed out, a great disposition to end in ulceration. According to Heinze,[5] out of 113 cases of typhoid fever examined at the Pathological Institution at Leipzig there were 13 cases of ulceration of the larynx. The ulceration sometimes involves a considerable surface, but it more frequently penetrates deeply and exposes the cartilages. It is generally at the posterior parts of the larynx, that is, *at the under part* in the prone position of a patient suffering from fever, that the disease is most frequently found; and it is commonly thought to be caused, at least in part, by hypostatic influences. Frequently, however, the sides of the epiglottis and the inter-arytenoid folds are ulcerated, and the disease in this situation has been attributed to friction. The cricoid cartilage is often seen to be denuded, and of a blackish gray color; and there is generally a corresponding discoloration of the opposite wall of the pharynx. There is some liability to œdema, but the ulcerative process more often

[1] See a paper entitled Pharyngotyphus, in Günburg's Zeitschrift, 1850, p. 155.
[2] Act. de la Soc. des Hôp., 1859, 4e fasc. p. 30.
[3] Dict. des Sc. Méd., Paris, 1864, vol. iv. p. 736.
[4] Trans. Path. Soc., vol. ix. p. 34, and vol. xi. p. 14.
[5] Die Kehlkopfsschwindsucht, Leipzig, 1879.

appears to originate in a typhous deposit—"laryngo-typhus being," as Rokitansky says, "the completion, as it were, of abdominal typhus." Tobold[1] states that the typhoid ulcer "commences in the mucous membrane as a circumscribed spot of congestion, which soon becomes yellow and depressed, sinks into the tissues, and losing its epithelium, constitutes the decubital-ulcer. From absorption of tissue the small ulcers gradually attain the size of a bean, and generally have irregular discolored edges." It is said that the cartilages often become independently diseased, *i. e.*, become affected without the subjacent tissues being primarily involved. So many conditions of the larynx, however, are met with which tend to the destruction of the cartilages that it seems unnecessary to resort to the theory that these structures are independently diseased. The further pathological changes will be found described under "Perichondritis of the Larynx." Secondary diphtheria is not uncommon in typhoid fever, but from the unconscious condition of the patient it is very often overlooked during life, and only discovered at the post-mortem examination. Though it most frequently commences in the larynx, and is often confined to that part, the diminished supply of air causes little inconvenience, owing to the medulla having, to a great extent, lost its sensibility to impressions. The obstruction to respiration is also less marked, from the fact of the disease, in most cases, attacking adults. Diphtheria rarely occurs before the end of the second week. The prognosis is very unfavorable, the prostrate condition of the patient preventing the use of antiseptic inhalations or local applications.

Treatment.—In the catarrhal affection soothing inhalations are useful. In the diphtheritic affection little can be done in the way of treatment, and there remains only the operation of tracheotomy, which in these cases offers little prospect of success.

Typhus.

The throat symptoms in typhus are similar to those met with in typhoid fever, but are much more rarely encountered.

Intermittent Fever.

Some practitioners make special mention of a sore throat connected with intermittent fever.[2] The affection is said to be characterized by periodicity, and to arise from palustral blood-poisoning. The treatment consists in the administration of quinine, as in cases of ague, the symptoms of which are supposed to be only marked by the local phenomena in the throat. It is, however, by no means certain that an angina of this nature really exists, the evidence forthcoming on the subject being both scanty and inconclusive.

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[1] Tobold: Laryngoscopie, etc., Berlin, 1874, p. 207 et seq.
[2] Peter: Loc. cit.; also Desnos: Dict. de Méd. et de Chir. Prat., vol. ii. p. 472.

ERYSIPELAS OF THE PHARYNX AND LARYNX.

Latin Eq.—Erysipelas pharyngis et laryngis.
French Eq.—Angine erysipélateuse.
German Eq.—Erysipelas des Schlundes und Kehlkopfs.
Italian Eq.—Risipola della faringe e della laringe.

Definition.—Erysipelas of the mucous membrane of the pharynx and larynx pathologically similar to the same malady when situated on the skin, and occurring either primarily or by extension from the face along the mucous tracts of the mouth, nose, or ear.

History.—The existence of an erysipelatous affection of the mucous tracts inside the body was recognized as early as Hippocrates,[1] who states: "When erysipelas extends from within outward it is a favorable symptom, but when it removes to the internal surfaces it is a deadly one. The signs of this occurrence are—disappearance of the external redness, with oppression on the chest, and difficulty of breathing." Subsequent writers studied the phenomena of the retrocession of erysipelas with more topical accuracy, and Fabricius Acquapendente[2] refers to a case of metastasis—a phenomenon of doubtful occurrence. During the eighteenth century many authors gave descriptions of erysipelas of the pharynx with more or less precision; and in 1757, Darluc,[3] in recounting the facts of an epidemic of erysipelas which occurred at Caillan in 1750, expresses himself thus clearly: "In some cases the morbific matter extended to the throat, and caused difficulty of deglutition; the voice became hoarse with a species of suffocation, swelling in the muscles of the neck, and all the symptoms of quinsy." Finally, in 1862, Cornil[4] almost exhausted the subject in an excellent article containing cases which illustrate nearly every phase of the disease.

Etiology.—The causes of erysipelas of the pharynx or larynx are evidently those of the same disease when situated on the external parts of the body. Thus most cases seem to recognize an epidemic or an endemic influence, whilst a small portion of the instances met with appear to occur sporadically. The etiology with respect to age and sex has not hitherto been established by a sufficient mass of statistics, but according to Cornil,[5] out of eighteen cases in which the pharynx was affected, fifteen patients were under the age of thirty, and two-thirds of the cases were females.

Symptoms.— *When the disease is confined to the pharynx* the primary phenomena vary considerably in different cases, and also diverge widely from the first symptoms of simple tonsillar inflammation. Previously to the efflorescence of erysipelas there is a well-marked febrile stage, in which the temperature sometimes rises as high as 104° Fahr. This initiatory fever may last for three or four days before any soreness is felt in the throat or the characteristic redness appears on the skin. In one class of cases—

[1] Coacæ Prenotiones, lib. II. cap. xiv.
[2] Opera Chirurgica, Pars Prior, lib. I. cap. viii.
[3] Journal de Méd. et de Pharmacie, juillet, 1757.
[4] Archiv. Générales de Méd., 1862, t. xix. pp. 257, 443.
[5] Ibid., p. 459.

the majority—the pharyngeal disease occurs as an extension of a similar attack on the face, whilst in another the mucous membrane is first affected. Out of eighteen cases analyzed by Cornil,[1] the erysipelas twice appeared simultaneously on the face and in the pharynx, the throat was the primary seat of the disease seven times, and on nine occasions the skin was attacked first. The propagation of the malady from the face to the pharynx, and *vice versa*, was observed to take place by four different routes, viz.: (1) Most frequently by the lips and mucous membrane of the mouth ; (2) by the nasal fossæ ; (3) by the Eustachian tube, the middle ear, and the external auditory meatus, and (4) by the nasal fossæ and the lachrymal sac and ducts to the conjunctiva and eyelids. In none of the cases was there any metastasis, but the disease spread by continuity of tissue, and the erysipelatous redness could be traced step by step along the paths indicated. In a case reported by Gull[2] the erysipelas spreading from the pharynx reached the face almost at the same time by the auditory and lachrymal channels. I have myself only met with four undoubted cases of erysipelas of the pharynx. In three of these the disease spread from the pharynx to the face—twice by the nose, and once by the mouth and lips. In none of these cases was the diagnosis made out till the erysipelas reached the skin. In the other case the affection commenced in the auricle of the right ear and spread through the Eustachian tube to the uvula and left tonsil. The following were the sexes and ages of my patients : A man aged 58, and three women aged 47, 28, and 17. When the disease arrives at the pharynx, the patient complains of pain and difficulty in deglutition. Swelling of the submaxillary and cervical glands is almost constantly present, and to such an extent that, in many cases, the patient can scarcely open his mouth. Stiffness of the jaw from this cause is sometimes complained of before anything can be seen on the skin or in the pharynx, and there is often considerable ptyalism from implication of the parotid and salivary glands. The pharyngeal lesion may terminate in gangrene.[3] In conjunction with so serious a phase of the disease, all the constitutional symptoms are much aggravated, and when mortification takes place the symptomatic fever assumes a low typhoid form, and there is a tendency to death by collapse. On inspecting the pharynx the appearance of the mucous membrane, when affected with erysipelas, differs considerably according to the form of the disease which is present ; the local phenomena are always very different from those of tonsillitis, but often cannot be distinguished from simple inflammation of the part. Cornil[4] makes three divisions of the malady, viz., (1) erysipelas with simple redness ; (2) erysipelas with phlyctenulæ ; and (3) erysipelas terminating in gangrene. Thus it may be seen that erysipelas, when situated on the mucous membrane, tends to pursue a course exactly the same as when it affects the skin. In the first and mildest variety the pharynx presents a diffuse hue of deep purplish red, and has a shining aspect as if the mucous membrane were covered with a varnish. A variable amount of œdematous swelling can also be generally perceived. The abnormal coloration extends over the veil of the palate and anterior surface of the uvula, over the pillars of the fauces and tonsils on both sides, and over the posterior wall of the pharynx. When bullæ arise, all the symptoms, both local and constitutional, are increased to an intensity which clearly indicates a severer expression of the disease. The vesicles

[1] Loc. cit. p. 449.
[2] Medical Gazette, 1849, on the Alliances of Erysipelas.
[3] Cornil : Loc. cit. p. 453.
[4] Ibid. p. 262.

vary in size from that of a millet seed to a small nut, last but a few hours, and are filled with serum, pus, or even with blood, according to the observations of Cuire.[1] It is often very difficult, except by collateral signs, to distinguish these bullæ from herpes. On their disappearance they leave in their place a whitish yellow patch of softened tissue, which is easily torn from the structures beneath by the act of swallowing or coughing. Under these circumstances, membranous shreds may be seen hanging at various points from the surface of the pharynx. Thus the greater part of the mucous membrane desquamates at the termination of such an attack. After this process has ceased, and all redness and pain have likewise disappeared, an injection of the superficial veins of the pharynx remains for a while, and constitutes for some time the last stage of the morbid action. Most cases terminate in resolution, but in a few instances the intensity of the inflammation has led to gangrene of portions of the mucous membrane and the submucous tissues. The occurrence of mortification can be readily recognized by the characteristic odor, and by the dark, pultaceous appearance of the affected spots of the pharynx. In the four cases which I have seen, recovery took place, though in one instance abscesses formed on the ala of the nose and in the cheek.

Erysipelas most commonly reaches *the larynx* by extension from the pharynx, but the former organ may be primarily affected, whilst the pharynx remains healthy. Porter[2] has described the case of a woman, aged 35, who was admitted into one of the Dublin hospitals, on account of enlarged spleen and anasarca of the extremities. Unfortunately, she was placed in the next bed to a patient convalescent from erysipelas, and in a few days she took that complaint. The left eye first became swollen and the pharynx inflamed, and the disease soon extended to the larynx. The patient died comatose, from œdematous laryngitis, three days after the face was attacked. Sometimes the poison of erysipelas confines itself to the larynx, the skin being free from inflammation; at other times it passes from the larynx to the external parts. Cases of the former kind have been already placed on record by Cuire,[3] and another one is now added (see page 147). In erysipelas of the head and neck there is generally more or less congestion of the mucous membrane of the larynx. Occasionally, though less frequently, the affection appears to originate in hospital-gangrene.[4] The symptoms of the disease are difficulty in swallowing, hoarseness or loss of voice, and pain, which is increased on pressure externally. Dr. Semeleder[5] examined four cases of erysipelas of the face, with the laryngoscope, and in all of them he found inflammatory redness and swelling of the epiglottis and larynx down to the vocal cords, though there was no dyspnœa or dysphonia. The inflammatory symptoms in the larynx disappeared gradually with the desquamation of the skin; and in one case a relapse of the cuticular affection was accompanied by a recurrence of laryngeal inflammation. Sometimes the disease is much more active and may result in an acute œdema, which rapidly tends toward a fatal termination.

According to Peter[6] the malady may extend still further down the

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[1] De l'Erysipèle du Pharynx, Thèse de Paris, 1864, No. 136.

[2] Observations on the Surgical Pathology of the Larynx and Trachea, London, 1837, p. 104

[3] Op. cit. pp. 73–77.

[4] Ryland: Diseases of the Larynx, p. 8.

[5] Loc. cit.

[6] Dict. des Sciences Méd., Paris, 1866, vol. iv. p. 723.

respiratory tract, and he states that in one instance he has seen it lead to "galloping consumption."

Diagnosis.—The diagnosis of erysipelas of the pharynx and larynx cannot but remain doubtful except where it is accompanied by manifestations on the skin. Indisputable as is the occurrence of erysipelas as an enanthem, there are no pathognomonic signs by which the disease can be recognized when confined to the mucous tracts.

Pathology.—Erysipelas consists essentially in a local manifestation on the skin or mucous tracts of a general blood-poisoning. When situated internally, the morbid action is confined to the mucous membrane and submucous tissues. The vessels of the part are loaded with effete elements, and the cellular tissue becomes infiltrated with unhealthy serum. Where gangrene takes place the muscular fibres are softened and separated, but their substance is seldom destroyed. The course of the malady is too rapid for the process of sphacelus to extend deeply. In a case examined by Cornil,[1] where the larynx had become affected, the aryepiglottic folds were reduced to a mass of "*putrilage*," but the cartilages were left intact. In another case reported by the same author, gangrene of the palate and death having supervened, the autopsy revealed softening of all the superficial structures of the pharynx. The mucous membrane was in several places reduced to a pulp, and the uvula was torn from the soft palate by a slight effort of traction.

Prognosis.—The local lesions occasioned by erysipelas are usually subordinate to the severity of the general blood-poisoning. The intensity of the constitutional phenomena must guide us in giving a prognosis as to the probable termination of the attack. The dictum of Hippocrates, already referred to, has been confirmed by modern observation. Thus in nine cases analyzed by Cornil,[2] where the face was first attacked, seven deaths occurred, whereas in nine other instances where the enanthem preceded the skin eruption, seven recoveries took place. The extension of erysipelas to the throat marks an increased intensity of the blood-poisoning, and in the majority of cases the disease is not limited to the pharynx. It spreads down the windpipe and œsophagus, and by giving rise to œdema of the glottis, capillary bronchitis, and lesions of the alimentary canal, tends to a fatal issue.

Treatment.—Both local and constitutional measures must be adopted in erysipelas of the throat. As regards topical applications, I have seen benefit resulting in two cases of pharyngeal erysipelas from the insufflation twice daily of morphia (gr. $\frac{1}{4}$) diluted with starch, whilst ice was constantly sucked and bromide of potassium given every four hours. Hot soothing inhalations should not be used as long as there is any chance of arresting the inflammation. Should the disease terminate in gangrene, we must resort to antiseptic gargles of permanganate of potash, chlorate of potash, carbolic acid, etc., whilst if œdema of the glottis become developed, recourse must be had to scarification of the larynx, and in extreme cases to tracheotomy. Perchloride of iron should be administered internally, and if the vital powers sink low, bark and ammonia, with a free allowance of stimulants, will be required. The diet throughout the whole course of the disease should be of the most nutritive description.

The following case illustrates the rare form of the disease in which the larynx is affected with erysipelas, whilst the pharynx and skin are unaffected:

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[1] Loc. cit. p. 446.

[2] Loc. cit. p. 458.

ERYSIPELAS OF THE LARYNX—LARYNGOTOMY—DEATH.

(Reported by Dr. PORTER, now of St. Louis.)

"James S——, aged 35, a strong, vigorous man, was admitted into the London Hospital, January 19, 1874, for the fracture of the right internal malleolus. For ten days the patient did very well, but then complained of pain in the throat and hoarseness. On the following day there was some dyspnœa, whilst the pain and hoarseness were more marked. His temperature was 102°, pulse 132, and respirations 36 to the minute. A laryngoscopic examination on the succeeding day discovered that the mucous membrane of the epiglottis and of the arytenoid cartilages was acutely inflamed. The ventricular bands were so much swollen as to cover the vocal cords. The patient was aphonic and the pain very intense. There was only very slight pharyngeal congestion. Inhalations of benzoin and mild astringent applications were used, and warm fomentations were applied to the neck. Dr. Morell Mackenzie saw the patient the next day, and found great tumefaction of the epiglottis, the mucous membrane of which was thickened and eroded. In consequence of the general swelling the vocal cords could scarcely be seen. The outer side of the neck was also somewhat tumefied. During that evening the patient became rapidly worse. Pulse 160; respirations 44 to the minute and labored; temperature 103°.

"Laryngotomy became necessary early in the night. There was considerable hemorrhage, but the patient appeared very much improved by the operation. On the next morning, a dark flush was seen around the tracheal wound; breathing was again difficult and dysphagia increased. There was a distinct friction sound at the apex of the heart, and dulness at the bases of both lungs. The following day the patient was much worse, and the flush around the wound had increased in size and density. The dyspnœa was more marked, and the dysphagia so great that no nourishment could be taken. Death ensued at ten o'clock that evening. [There were two cases of erysipelas in the same ward when the patient was admitted, and several of the attendants of the patients were subsequently attacked with sore throat.]

"The *autopsy* showed that the heart was healthy, but the lungs were œdematous and of a dark color. The larynx was greatly altered, the mucous membrane covering the epiglottis and the arytenoid cartilages being swollen and ulcerated; the lining membrane of the bronchi was bright red. The traumatic affection of the leg showed no sign of erysipelas, the healing process appearing to have proceeded satisfactorily."

SECTION II.—THE LARYNX.

ANATOMY OF THE LARYNX.

This complicated organ, which serves the double purpose of transmitting air and producing the voice, is situated between the hyoid bone above and the trachea below, having behind it the pharynx, and on each side of it the great vessels and nerves of the neck. When the head is held upright and the larynx is at rest, the middle of the thyroid cartilage is opposite the body of the fifth cervical vertebra, the whole organ from the tip of the epiglottis to the lower border of the cricoid cartilage corresponding to the third, fourth, fifth, and sixth cervical vertebræ. But the position of the larynx is very far from constant, as it ascends and descends to a variable degree during respiration, phonation, and deglutition.

Viewed from the front, the general external configuration of the larynx is as follows: Passing from above downward there may be recognized by palpation, or indeed by mere inspection in thin persons: a protuberance (Pomum Adami) less prominent in females and boys before puberty, formed by the meeting in the middle line of the two alæ of the thyroid cartilage; above the laminæ is a deep notch, while below them is the depression for the crico-thyroid membrane, and again lower down the convexity of the cricoid cartilage. Laterally the quadrilateral laminæ of the thyroid cartilage partially covered by the depressors of the hyoid bone may be made out, while below the lower border of the cricoid can be seen or felt a depression corresponding with the junction of that cartilage with the trachea. Still lower there may be noticed, in the middle line, a slight protuberance, the isthmus of the thyroid body, and on either side the lobes of this body, which vary considerably in their development, and in women, generally, give a more rounded form to the neck than in men. Below this crossing of the isthmus the trachea recedes between the converging sterno-cleido-mastoids, and finally disappears behind the suprasternal notch.

The posterior surface of the larynx constitutes the anterior wall of the pharynx.

The upper surface presents in front the ligament, which unites the upper border of the thyroid cartilage with the hyoid bone, and the epiglottis with its five folds of mucous membrane; further back, the superior aperture of the larynx, cordiform in shape, descending in an inclined plane with the larger extremity in front, and limited anteriorly by the epiglottis, laterally by the ary-epiglottic folds, and behind by the apices of the arytenoid cartilages and the upper border of the arytenoid muscle covered with mucous membrane.

The inferior surface of the larynx, corresponding with the lower edge

of the cricoid cartilage, presents the ligament which unites that cartilage with the first ring of the trachea, and the annular opening into the windpipe.

The consideration of the internal surface of the larynx is best deferred till the cartilaginous skeleton and other component parts have been described.

The framework of the larynx is composed of a series of cartilages, nine in number, three being single and three in pairs. The former are known as the thyroid and cricoid cartilages, and the epiglottis. The latter are the arytenoids, and the cartilages of Wrisberg and Santorini. There are also the sesamoid cartilages. The chief portions of the laryngeal framework are so articulated with one another by ligaments as to be capable of a considerable number of movements, which are produced by means of muscles, the function of which is to place the vocal cords in the proper position for phonation. The internal surface of the cartilages, ligaments, joints, muscles, and vocal cords is covered by mucous membrane, and the entire apparatus is supplied with blood-vessels, lymphatics, and nerves.

The thyroid cartilage is the largest portion of the laryngeal framework, and may be described as consisting of two symmetrical four-sided plates, united together in the middle line by an intermediate lamina. They include between them an angle of about 90°, and are somewhat obliquely inclined, so that their external surfaces look slightly downward. The inferior border of each plate is nearly horizontal, the posterior vertical, while the upper border is sinuous, being concave behind, and boldly convex in front. In the united plates this convexity leads to the formation of a deep notch, which serves for the attachment of the thyro-hyoid membrane. The posterior angles of each plate present two hook-shaped processes, named respectively the greater and lesser cornua. The former projects upward and somewhat inward from the superior angle, and is connected by means of ligaments with the greater cornu of the hyoid bone. The latter projects downward and somewhat forward from the inferior angle, and presents on the inner surface of its extremity a facet for articulation with the cricoid cartilage.

Placed immediately below the thyroid, and connected with it by means of the articulation just mentioned, is the cricoid cartilage. Its general form is that of a signet ring, the portion representing the seal being placed posteriorly, while the thin and narrow portion corresponding to the ring, but which in this case takes up only a fourth of the whole circumference, is placed in front. Its inner surface is continuous with that of the trachea, being convex from above downward. Its external surface is plane, and presents in front a prominence between the attachments of the crico-thyroid muscles, posteriorly in the middle line a low vertical ridge, broader below than above, separating shallow depressions for the posterior crico-arytenoid muscles, and on each side an articular facet for the lesser cornu of the thyroid cartilage. This facet, which is circular in form and concave, looks upward, and is seated upon a wart-like prominence placed halfway between the upper and lower margins of the cartilage, and slightly anterior to the facet for the arytenoid. The upper border of the cartilage is horizontal posteriorly, but slopes rapidly downward and forward on each side, and ends in front in a broad but deep notch, to which is attached the crico-thyroid membrane. Just beyond its horizontal portion the upper border presents on each side a sloping oval facet for articulation with the corresponding arytenoid. The lower border is

horizontal, and is connected with the first ring of the trachea, slightly overlapping it anteriorly.

The arytenoid cartilages are situated at the posterior part of the larynx and articulate with the cricoid, upon which they are very freely movable. They are pyramidal in shape with their apices flattened and curved toward the middle line, and their bases obliquely sloped off so as to have an inward aspect. They have attached to them both the vocal cords and ventricular bands. Each cartilage presents for examination a posterior, an anterior or lateral surface, an internal or median surface, and a base. The base, by means of which the cartilage articulates with the facet on the upper border of the cricoid, is concave from before backward, and presents two well-marked processes. One, the processus vocalis, is a prolongation of the angle formed at the junction of the base with the lateral and median surfaces; it projects forward into the larynx, and gives attachment to the true vocal cord. The other, the processus muscularis, is connected with the external angle of the base, and gives attachment to the posterior and lateral crico-arytenoid muscles.

The smaller cartilages may be briefly dismissed. The cartilages or cornicula of Santorini are two small masses of fibro-cartilage, about as large as millet-seeds, and situated at the apex of the arytenoids. The cartilages of Wrisberg are two soft fibro-cartilaginous plates embedded in a group of mucous glands occupying the ary-epiglottic folds, and are occasionally wanting. The sesamoid cartilages are very far from constant, but when present they occur in the form of two small elongated masses, attached by means of elastic fibres along the lateral border of each arytenoid.

The epiglottis is a fibro-cartilage, which varies somewhat in shape. When seen from behind it has a leaf-like form, with its stalk below and expansion above. Removed from the pharynx and placed with its anterior surface uppermost and stalk foremost, it has very much the shape of an elongated saddle. As seen with the laryngoscope it varies very much in appearance, according to its inclination in relation to the thyroid cartilage, and according to the extent its expanded portion curls round on itself. In adults it is, in most cases, almost vertical, but in children it is often obliquely horizontal—lower behind than in front. It is attached by its lower margin to the inner surface of the thyroid cartilage by means of a firm band of elastic tissue, and at this point forms a projection, which in life (seen from above) has a rounded form, and is called the cushion of the epiglottis. Its free upper margin rises above the base of the tongue, with which it is loosely connected by means of three reduplications of mucous membrane—the glosso-epiglottic folds. The anterior surface is concave vertically, and convex from side to side, while the posterior surface is curved in exactly reverse directions, and is pierced by numerous little pits, which contain the glandulæ opening on the surface of the mucous membrane. The margin of the epiglottis is sharp, and there is often a notch in the centre of its upper free edge. It gives attachment to the ary-epiglottic and pharyngo-epiglottic folds of mucous membrane.

The structure of the cartilages (with the exception of the epiglottis and cornicula) is hyaline; in the arrangement of the cells it differs from articular cartilage, but corresponds to the cartilages of the ribs, and like them is prone to ossify. The epiglottis and cornicula are fibre cartilages, and in man do not become ossified.

The ligaments of the larynx are: (1) the extrinsic, which unite the larynx with other parts; (2) the intrinsic, which unite the different parts

of the larynx together; and (3) the mixed, which serve both these uses. The extrinsic are the thyro-hyoid and the crico-tracheal. The thyro-hyoid ligaments are three in number, viz., the thyro-hyoid membrane in the middle line and the thyro-hyoid ligaments proper on either side. The thyro-hyoid membrane is a rather delicate band of elastic tissue, attached above to the posterior border of the body of the hyoid bone, and below to the margins of the superior thyroid notch. It has in front a bursa, and it is separated from the epiglottis behind by a considerable cushion of fat. The thyro-hyoid ligaments are cylindrical bands of fibro-elastic tissue uniting the greater cornua of the thyroid cartilage with the extremities of the hyoid bone. Between these ligaments and the thyro-hyoid membrane the hyoid bone is connected with the thyroid cartilage by means of a thin layer of fibrous tissue. The crico-tracheal ligament is a fine membranous expansion, which extends from the lower border of the cricoid cartilage to the first ring of the trachea.

The intrinsic ligaments are the crico-thyroid, the crico-arytenoid, the superior thyro-arytenoid, and the inferior thyro-arytenoid (vocal cords), whose ligamentous use, however, is entirely subservient to their higher function. The crico-thyroid ligament is a band of elastic membrane attached in front to the upper border of the cricoid and the lower border of the thyroid. The crico-arytenoid ligaments consist for the most part of scattered fibres, which assist in forming the capsule of the joint; on the posterior surface of the cricoid cartilage, however, near its upper border and outer corner, the ligamentous fibres are consolidated into a strong band, which is inserted into the posterior and inner surface of the arytenoid cartilage near its base. The superior thyro-arytenoid ligaments consist of only a few scattered fibres, which are not continuous, and though, to a great extent, constituting the ventricular bands, scarcely deserve the name of ligaments; they are inserted anteriorly in the receding angle of the thyroid cartilage, just above the insertion of the epiglottis. The inferior thyro-arytenoid ligaments are the most important structures in the larynx—the most essential features of the organ. They are formed of strong bands of yellow elastic tissue, extending from the receding angle of the thyroid cartilage, anteriorly, to the projecting angles at the base of the arytenoid cartilages (processus vocales). Examining them more in detail we find that each vocal cord is made up of fibres which are collected into a single band only at their anterior extremity; posteriorly they separate at an acute angle into three divisions; the first of these passes slightly upward, and is inserted just behind the posterior extremity of the ventricle; the second is attached to the processus vocalis of the arytenoid cartilage and to the surface of the cartilage above the process, and the third, dividing into five or six small bundles, is attached to the lower part of the inner surface of the arytenoid cartilage, some of its fibres extending beneath the capsule of the crico-arytenoid articulation and reaching the upper border of the cricoid cartilage. The vocal cords are covered with the mucous membrane of the larynx, and the fibres of the thyro-arytenoid muscle assist in forming a large proportion of their substance. When a vocal cord is drawn toward the median line, and a vertical section is made through it parallel with the anterior surface of the spinal column, it is seen to be triangular or prismatic. Two sides of the triangle are free, one directed upward toward the ventricular band, the other downward and inward toward the lower part of the opposite side of the trachea, and the third is the outer and attached edge. Sound is produced by the vibrations of the vocal cords when approximated.

The only mixed ligament is the epiglottic. It consists of an extrinsic and intrinsic portion. The former is composed of a central glosso-epiglottic ligament uniting the anterior surface of the epiglottis to the root of the tongue, and two hyo-epiglottic ligaments passing outward from the middle of the anterior surface of the epiglottis to the extremities of the body of the hyoid bone. The intrinsic portion, or thyro-epiglottic ligament, is a firm but narrow fibrous band connecting the lower end of the epiglottis with the thyroid cartilage just below its notch.

Between the cartilages and the mucous membrane of the larynx is a continuous layer of elastic fibrous tissue, which assists in supporting the general structure of the larynx, and effectually adds to its resiliency. It is attached below to the cricoid cartilage, becomes blended with the crico-thyroid ligaments, and enters into the formation of the vocal cords; it lines the ventricles of the larynx, and, thickening again, forms the ventricular bands. It can be traced into the ary-epiglottic folds, and after becoming firmly attached to the thyroid cartilage, forms the ary-epiglottic ligaments; anteriorly it becomes blended with the thyro-epiglottic and glosso-epiglottic ligaments. In those portions of the laryngeal tube where there are no ligaments connecting the movable cartilages with one another, this fibro-elastic lamina is very thin, and can be with difficulty separated from the mucous membrane.

The articulations of the larynx consist of the crico-thyroid and crico-arytenoid articulations, and the fibrous connections between the arytenoids and the cartilages of Santorini. The crico-thyroid articulation is composed of two true joints placed laterally, by means of which the lesser cornua of the thyroid cartilage articulate with the circular facets on the cricoid. These joints are provided with articular cartilages, synovial membranes, and capsular ligaments, and the movements they admit of are those of flexion and extension. The crico-arytenoid articulations consist of the two joints between the bases of the arytenoids and the facets on the upper border of the cricoid. Each joint is saddle-shaped, and is provided with a synovial membrane and a lax fibrous capsule, admitting of a very extensive series of movements. The articulation between each arytenoid and the corresponding cartilage of Santorini consists of a thin layer of fibro-elastic cartilage, which admits of very free movement in every direction.

The muscles of the larynx may be divided, for purposes of description, into three sets: First, a well-defined group on the anterior surface, connecting the cricoid cartilage with the lower border of the thyroid, and termed the crico-thyroidei; secondly, a pair of triangular muscles on the posterior surface of the cricoid cartilage, known as the crico-arytenoidei postici or abductors of the vocal cords; and, lastly, a group of smaller muscles in the upper part of the larynx, arranged in a somewhat sphincter-like manner, and including the thyro-ary-epiglottici, the arytenoideus, the thyro-arytenoidei externi and interni, and the crico-arytenoidei laterales or adductors. All the laryngeal muscles, with the exception of the arytenoideus, occur in pairs.

The crico-thyroideus muscle of each side may be easily shown, on dissection, to consist of two layers of fairly well-defined muscle, triangular in shape. In the superficial layer, the fibres pass in a more or less vertical direction, and this portion has been termed on this account the crico-thyroideus rectus. In the deeper layer, the oblique arrangement of the fibres has caused the muscle to be known as the crico-thyroideus obliquus. The former is attached below to the anterior surface of the cricoid carti-

Age close to the middle line, and spreading out as it ascends is inserted into the anterior third of the lower margin of the corresponding thyroid plate. The crico-thyroideus obliquus springs from the narrow anterior surface of the cricoid by two heads which embrace the attachment of the crico-thyroideus rectus, and running obliquely upward and backward is inserted into the posterior two-thirds of the lower margin of the corresponding thyroid plate, and the whole anterior border of the lesser horn.

The crico-arytenoideus posticus is a flat triangular muscle, which arises from a shallow depression external to the median ridge on the posterior surface of the cricoid ; its fibres converge as they pass upward and outward, and are inserted into the posterior margin of the base of the corresponding arytenoid cartilage, between the attachments of the arytenoideus and crico-arytenoideus lateralis.

The third group of laryngeal muscles, the arrangement of which, as already remarked, bears some resemblance to a sphincter, may be divided into three layers. The outermost layer consists of the two thyro-ary-epiglottici ; the middle layer of the arytenoideus, the thyro-arytenoidei externi, and the crico-arytenoidei laterales ; while the innermost layer consists of the two thyro-arytenoidei interni.

The thyro-ary-epiglotticus is a flat, narrow muscle, which, taking origin from the processus muscularis of the arytenoid cartilage, passes upward and inward, crosses its fellow in the middle line, and is inserted into the upper half of the lateral border of the arytenoid of the opposite side, and the posterior border of the corresponding cartilage of Santorini. The lower fibres, after their attachment to the arytenoid, run forward and slightly downward, to be inserted into the thyroid cartilage near its receding angle, while the fibres which are attached to the Santorinian cartilage are continued forward and upward into the ary-epiglottic fold, where they are joined by certain scattered fibres which arise from the thyroid cartilage, close to the anterior attachment of the muscle.

The arytenoideus is a flat quadrilateral muscle attached to the lateral borders of the arytenoid cartilages, and running horizontally between these attachments. It is covered posteriorly by the thyro-ary-epiglottici, while in front it is in direct relation with the laryngeal mucous membrane. The thyro-arytenoideus externus usually consists of three portions, a lower, middle, and upper, the two latter being, however, occasionally absent. The lower portion may again be divided into two layers, an external and an internal. These arise side by side from the lower half of the internal surface of the thyroid cartilage, close to its receding angle, and from the fibrous expansion of the crico-thyroid ligament, and pass backward to be inserted into the lateral border of the arytenoid cartilage. The inner portion runs in a horizontal direction, and is attached to the lower half of this border, while the outer portion passes obliquely upward, to be attached to the upper half, some of its fibres passing to the cartilage of Wrisberg and the ary-epiglottic fold. The middle portion of the thyro-arytenoideus externus takes origin from the angle of the thyroid cartilage close to its upper notch, and running obliquely downward is inserted into the processus muscularis of the arytenoid cartilage. The upper portion of the muscle is also attached to this process, but its upper attachment is to the lateral border of the epiglottis, and it serves the same function, and sometimes takes the place of the ascending fibres of the thyro-ary-epiglotticus. The crico-arytenoideus lateralis arises from about the middle third of the upper border of the cricoid cartilage, and is inserted into the

whole anterior margin of the base of the arytenoid, a few fibres occasionally passing on to join the thyro-ary-epiglotticus.

The thyro-arytenoideus internus is a prism-shaped muscle, which arises from the angle of the thyroid cartilage, just internal to the origin of the thyro-arytenoideus externus, and running parallel to, and in the substance of the vocal cord, is inserted into the apex and upper and lower surfaces of the processus vocalis. On transverse section it is seen to have three borders, the inner of which projects into the vocal cord, while the two outer and the side of the muscle between them lie upon the inner surface of the thyro-arytenoideus externus of the same side.

Lastly, there remains to be mentioned a muscle which is only exceptionally present, and which has been variously termed the crico-thyroideus posticus, and the kerato-cricoideus. It consists of a narrow band of fibres which arises from the posterior surface of the cricoid cartilage just below the origin of the crico-arytenoideus posticus, and passing upward and outward is inserted into the posterior margin of the lesser cornu of the thyroid cartilage.

The laryngeal muscles have two different functions to perform. They have, first, to control the entrance into the larynx, opening it and closing it as circumstances may require ; and, secondly, to provide for the proper tension of the vocal cords during phonation. These functions, however, are not entirely independent of each other. The muscles which narrow or close the entrance to the larynx include, in the first place, all those fibres which ascend to be attached to the epiglottis, as well as those which encircle the vestibule; secondly, the laryngeal inlet is constricted by the arytenoideus, which approximates the arytenoid cartilages to each other ; thirdly, the true glottis is closed by the action of the thyro-arytenoidei interni and the crico-arytenoidei laterales, both of which muscles are able to rotate the arytenoid cartilages on their bases, and to approximate their vocal processes. The contrary action, viz., the widening of the glottis, is effected by the crico-arytenoidei postici, which rotate the arytenoid cartilages outward, and so separate the posterior attachments of the vocal cords. The muscles which preside over the tension of the vocal cords are the crico-arytenoidei postici, the crico-thyroidei obliqui and recti, and the thyro-arytenoidei interni. The first-named muscles fix the arytenoid cartilages upon the cricoid ; the crico-thyroidei draw the angle of the thyroid cartilage forward and downward in relation to the cricoid ; while the thyro-arytenoidei interni, by their contraction and expansion, produce in the vocal cords the degrees of tension necessary for the production of notes of different pitch.

The arteries of the larynx are the superior laryngeal, the middle laryngeal or crico-thyroid, and the inferior or posterior laryngeal. The superior laryngeal is in most cases derived from the superior thyroid, though it occasionally springs immediately from the external carotid. Running almost directly inward between the greater horn of the hyoid bone and the upper border of the thyroid cartilage, it passes beneath the thyro-hyoid muscle and enters the larynx by perforating the thyro-hyoid membrane. Having sent an epiglottic branch upward, it passes obliquely downward toward the middle of the lower border of the thyroid plate, supplying in its course the muscles and the mucous membrane in the upper part of the larynx. Just before reaching the lower border of the thyroid cartilage it divides into two terminal branches, the larger of which anastomoses with the crico-thyroid, and the smaller with the inferior laryngeal artery. The middle laryngeal or crico-thyroid artery arises from the superior thyroid

nearly opposite the upper margin of the thyroid cartilage, and passes downward and forward, lying upon the thyro-pharyngeus and thyro-hyoid muscles. Arrived at the lower border of the thyroid cartilage it divides into two branches, the outer of which passes into the larynx below the inferior margin of that cartilage, and joins a branch of the superior laryngeal, while the inner division, uniting with its fellow on the opposite side, perforates the crico-thyroid ligament and is distributed to the laryngeal mucous membrane below the vocal cords. The inferior or posterior laryngeal artery is derived from a branch of the inferior thyroid, and passing upward, together with the inferior laryngeal nerve, behind the crico-thyroid articulation, divides into two branches, one of which unites with a branch of the superior laryngeal, while the other is distributed to the crico-arytenoideus posticus muscle.

The veins of the larynx for the most part have a similar arrangement to that of the arteries, but their anastomoses with each other and with the veins of the thyroid glands, the root of the tongue and the trachea, are more numerous. They terminate in the internal jugular.

The lymphatics of the larynx are abundantly supplied to the mucous membrane, but the cartilages, muscles, and ligaments are described as being entirely destitute of them. They are arranged in the form of a thick network, which closely follows the arrangement of the mucous membrane, but the vessels are much narrower and the meshes much wider on the posterior surface of the epiglottis and along the true cords than in other parts of the laryngeal surface. The lymphatic capillaries of the larynx unite together to form lymphatic trunks at four different points, two of which are situated above the right and left ventricle respectively, and two below the cricoid cartilage, one on each side. The upper trunks receive the lymphatics from the epiglottis and from the upper and middle compartments of the larynx, and pass outward between the greater cornua of the hyoid bone and the upper border of the thyroid cartilage to join lymphatic glands. The lower trunks receive the lymphatics from the lower compartment of the larynx, and terminate in lymphatic glands, situated on either side of the trachea.

The nervous supply of the larynx is derived from the superior and inferior or recurrent laryngeal nerves. These are branches of the pneumogastric nerve, but there is considerable evidence to show that those fibres which are derived from the spinal accessory nerve go, at least in part, to the laryngeal branches. The former is for the most part a sensory nerve, but it supplies a motor branch to one group of muscles, the crico-thyroids. The remaining laryngeal muscles are supplied from the inferior laryngeal, which is exclusively a motor nerve.

The superior laryngeal nerve divides into two branches opposite the greater cornu of the hyoid bone. The external or smaller branch descends over the thyro-pharyngeus muscle to the lower border of the thyroid plate, where it enters the crico-thyroid muscle. The internal branch enters the larynx by perforating the thyro-hyoid membrane, and passing inward and slightly backward, directly beneath the mucous membrane forming the floor of the sinus pyriformis, divides into numerous branches, which pass upward, inward, and downward. Some of these branches, the pharyngeal, are distributed to the mucous membrane of the pharynx as low down as the lower border of the cricoid cartilage, as well as to the sinus pyriformis and outer layer of the ary-epiglottic fold. Other branches, the laryngeal, supply the whole internal surface of the larynx.

The right recurrent nerve is given off from the pneumogastric just

below the level of the commencement of the ascending portion of the right subclavian artery, and, passing behind the carotid artery, ascends between the trachea and œsophagus, where it pierces the inferior constrictor and enters the larynx close behind the crico-thyroid articulation. In the first part of its course it is in proximity to the apex of the right lung. The left recurrent nerve is given off by the left pneumogastric on a level with the lower border of the arch of the aorta, and, winding round the transverse portion of the arch, it ascends to the larynx. After entering the larynx the nerves divide into branches which supply the laryngeal muscles.

The inner surface of the larynx may be divided into three portions, an upper, middle, and inferior, lying immediately one above another, and easily defined by natural limits.

The uppermost of these spaces, or vestibule of the larynx, is of a somewhat tubular form, but, owing to its sloping upper aperture, of greater depth in front than behind. It is bounded by the different cartilages, united together by reduplications of mucous membrane. Its upper boundary is identical with that of the larynx above described, while its lower margin is formed by the ventricular bands. The anterior wall of the vestibule is formed by the epiglottis, and is convex in its upper third, concave in its middle third, corresponding to the insertion of the pharyngo-epiglottic folds, while its lower third is a boldly projecting, round protuberance, the epiglottic cushion, the inferior border of which, becoming gradually smaller, changes into a sort of triangular gutter between the anterior extremities of the ventricular bands. The lateral walls of the vestibule, which form a furrow with the anterior, decrease in depth from before backward, and are formed by the ary-epiglottic ligaments, and their reduplications of mucous membrane. The posterior wall is formed by the cartilages of Santorini, and those segments of the arytenoid cartilages to which are attached the superior vocal cords.

The middle compartment of the larynx is bounded above by an imaginary plane uniting the ventricular bands below by the true cords, while its lateral boundaries are the two ventricles or pouches of Morgagni contained between these structures. The aperture between the ventricular bands is more or less oval in shape, but wider behind than in front; it slopes obliquely downward and backward, and terminates in the fissure separating the arytenoids. The inferior boundary of the cavity is constituted by the true vocal cords, the space between them being known as the rima glottidis. This space is in the adult about four-fifths of an inch in length, and, when the vocal cords are separated to their utmost, about half an inch across at its widest part. The glottis is larger in life than the cadaveric position of the vocal cords would indicate, the abductors being more powerful than the adductors. During quick inspiration and expiration, a condition corresponding with its greatest distention, its form is that of an isosceles triangle with its base posterior and its angles rounded off, but on forcible expiration, the edges of the rima approximate, and the vocal cords become parallel. The ventricle of Morgagni is oblong in shape, extending for about the length of the cords, and having externally the thyro-arytenoid muscle, and its mucous covering. Its external wall presents two crescentic folds of mucous membrane, between which is a deep fossa, and posteriorly a smaller funnel-shaped depression; while passing upward to the vestibule, between the cartilages of Santorini and Wrisberg, is a shallow channel, the filtrum.

The inferior laryngeal space is bounded by the cricoid cartilage, the

lower half of the angle of the thyroid cartilage, the vocal processes of the arytenoid cartilages, and the elastic and mucous structures, which extend downward from the free borders of the vocal cords; laterally the walls of this space diverge below the cords to the calibre of the commencement of the trachea.

The internal surface of the larynx is covered throughout by a mucous membrane, continuous above with that of the tongue and pharynx and below with that of the trachea. In passing from the root of the tongue in front to the anterior surface of the epiglottis, it presents three well-marked reduplications—the glosso-epiglottic folds—one central and two lateral, including between them two shallow fossæ. Laterally it descends from the pharynx over the palato-pharyngeus muscle, to be attached to the upper portion of the inner surface of the thyroid cartilage, whence it passes again upward, external to the thyro-ary-epiglotticus, to form the outer layer of the ary-epiglottic fold. The fossa thus formed is termed the sinus pyriformis. In front of the vestibule the mucous membrane is firmly attached to the posterior surface of the epiglottis, and below that cartilage to the receding angle of the thyroid, forming a well-marked furrow between the anterior attachments of the ventricular bands. The mucous membrane covering the lateral wall of the vestibule is smooth in front, but as it approaches the middle line behind, it dips slightly down between the Wrisbergian and arytenoid cartilages to form the filtrum, a shallow furrow, which passes downward and forward, and ends in the ventricle of Morgagni. Still further back the mucous membrane is firmly attached to the median surface of the arytenoid cartilage. Passing downward, the mucous lining of the vestibule is continued over the ventricular band, to which it is somewhat loosely attached, into the ventricle of the larynx. It covers the whole internal surface of this cavity, presenting the folds and fossæ which have been described above, and passing again inward attaches itself firmly to the sharp edge of the true cord. Between the cords, posteriorly, it loosely covers the anterior surface of the arytenoideus muscle, being thrown into vertical folds on the contraction of this muscle, and the resulting approximation of the arytenoids. Below the vocal cords the mucous membrane is attached rather closely to the inner surface of the cricoid cartilage, whence it is continued downward to form the tracheal lining.

The laryngeal mucous membrane presents both tesselated and ciliated epithelium. The latter has the more general distribution, the tesselated cells being confined to the upper and under surfaces of the epiglottis, to a narrow zone just within the upper aperture of the larynx, and to the projecting edges of the true cords, which are covered by a band of large, flattened, angular cells. In these parts the epithelial layer is in direct contact with the mucosa, but, elsewhere, it rests upon a transparent homogeneous basement or limitary membrane, a structure which plays an important part in the pathology of laryngeal diphtheria. It occasionally presents itself as an entirely independent layer, which can be separated without difficulty from the subjacent structures, but as a rule it is intimately connected with the fibrous tissue of the mucosa. According to Luschka, however, a homogeneous basement membrane only exists in the vicinity of the true cords, and even here it contains both fibrillæ and colonies of cellular elements. The mucosa itself consists of a connective tissue of delicate fibrils enclosing numerous proliferating masses of cells. These cells, which are finely granular, and consist of a distinct nucleus enclosed in a thin layer of protoplasm, vary considerably in size and num-

ber, being least numerous in the mucous covering of the true cords. Luschka regards them as the real matrix of the laryngeal epithelium, and assigns them an important share in all inflammatory affections of the larynx. The presence of these proliferating cell-masses is the chief distinguishing mark between the mucosa and the next layer of the mucous membrane, the submucosa. The latter consists of numerous wavy elastic fibrillæ, which run more or less parallel to the surface and are, as a rule, longer and somewhat coarser than the fibres of the mucosa. They enclose here and there spindle-shaped cells, which consist of an elongated, finely granular nucleus, and a thin layer of protoplasm, prolonged at one end into a wavy, tail-like process. The laryngeal mucous membrane presents very few papillæ, and these only in certain limited regions, viz., upon the anterior surface of the epiglottis, and along the edge of the true cords. Throughout the larynx the mucous membrane is richly provided with glands, which occur both solitary and in groups. They are plentifully scattered over the prominence of the base of the epiglottis, along the furrows on each side of that cartilage, in the neighborhood of the cartilages of Wrisberg, on the ventricular bands, and throughout the walls of the ventricles, with the exception of the upper surfaces of the vocal cords. They are also irregularly distributed over the posterior wall of the larynx, especially in the neighborhood of the crico-arytenoid articulations.

For further details the anatomical student is referred to the following works which have been largely laid under obligation by the author:—Luschka: "Der Kehlkopf des Menschen," Tübingen, 1871; Henle: "Handbuch der systematischen Anatomie des Menschen," Zweite Auflage, Braunschweig, 1873; and "Manual of Human and Comparative Histology," by Professor Stricker, translated by Henry Power, M.B. New Sydenham Society's Trans., London, 1872.

THE LARYNGOSCOPE AND ITS ACCESSORY APPARATUS.

History of its Invention.—There is no trace of a laryngoscope before the middle of the eighteenth century, but in the year 1743 M. Levret, a distinguished French accoucheur, whose highly inventive genius had led him to contrive surgical instruments of almost every description, occupied himself in discovering means, whereby polypoid growths in the nostrils, throat, ears, and other parts, could be tied by ligatures.[1] It is unnecessary to describe here the various ingenious instruments which he invented for the purpose, but it may be observed that in using them he employed a speculum which differed from the various *specula oris* then in use. It consisted mainly of a plate of polished metal (*plaque polie*), which "reflected the luminous rays in the direction of the tumor," and at the same time received the image of the tumor on its reflecting surface.

About the year 1804, a certain Dr. Bozzini, of Frankfort-on-the-Main, caused a great sensation throughout Germany, with his invention for illuminating the various canals of the body. He had made known his ideas a few years previously, but it was not till 1807[2] that he published a work

[1] Mercure de France, 1743, p. 2434.

[2] Der Lichtleiter, oder Beschreibung einer einfachen Vorrichtung, und ihrer Anwendung zur Erleuchtung innerer Höhlen und Zwischenräume des lebenden animalischen Körpers. Von Philipp Bozzini, der Medizin und Chirurgie Doctor, Weimar, 1807.

on the subject. Bozzini's invention consisted of two essential parts: First, a kind of lantern; and, secondly, a number of hollow metal tubes (*specula*) for introducing into the various canals of the body. The lantern was a vase-shaped apparatus made of tin, in the centre of which was a small wax candle. In the side of the lantern there were two round holes, a larger and a smaller one, opposite each other. To the smaller one an eye-piece was fixed, to the larger the speculum was fitted. The flame of the candle was situated just below the level of these two apertures. The mouth of the speculum—a tube of polished tin or silver—was always of the same size; but the diameter of the tube beyond its orifice varied according to the canal into which it had to be introduced. The apparatus was about thirteen inches high, two inches from before backward, and rather more than three from side to side. In employing reflected light, Bozzini had the speculum divided by a vertical partition, so that there were, in fact, two canals and two mirrors. One of these mirrors was intended to convey the light, the other to receive the image.

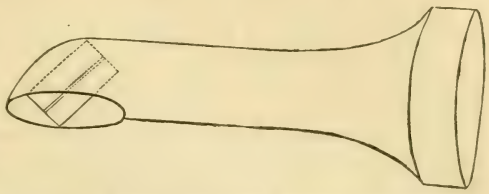

FIG. 11.—Bozzini's Laryngeal Speculum (*after Hufeland*). In the drawing from which this is taken, the mirrors are directed upward, as they would be when employed in rhinoscopy.

In the year 1825,[1] M. Cagniard de Latour, the successor of Savart at the French Academy of Sciences, and like him, an earnest investigator of the physiology of the voice, made an unsuccessful endeavor to examine the larynx during life.

In the year 1827,[2] Dr. Senn, of Geneva, "had a little mirror constructed for introduction to the back of the pharynx; with it he tried to see the upper part of the larynx—the glottis; but he gave up its use on account of the small size of the instrument."

In the year 1829,[3] Dr. Benjamin Guy Babington exhibited at the Hunterian Society of London an instrument closely resembling the laryngoscope now in use. Two mirrors were employed, one smaller, for receiving the laryngeal image, the other larger, for concentrating the solar rays on the first. The patient sat with his back to the sun, and, whilst the illuminating mirror[4] (a common hand looking-glass) was held with the left hand, the laryngeal mirror—a glass one coated with quicksilver—was introduced with the right.

In the year 1832,[5] Dr. Bennati, of Paris, used an instrument made by one of his patients named Selligue. It consisted of a double-tubed speculum, one tube of which served to carry the light to the glottis, and the other to bring back to the eye the image of the glottis reflected in the mirror, placed at the guttural extremity of the instrument.

In the year 1838,[6] M. Baumès exhibited at the Medical Society of

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[1] Physiologie de la Voix, par Edouard Fournié, Paris, 1865, p. 352.
[2] Journal des progrès des sciences, etc., 1829, p. 231, note.
[3] Lond. Med. Gaz., London, 1829, vol. iii. p. 555.
[4] Illustrations of this instrument will be found in my work on The Laryngoscope, 3d edition, p. 14.
[5] Recherches sur le Mécanisme de la Voix Humaine, p. 37, note.
[6] Compte rendu des Travaux de la Société de Médecine de Lyons, 1836-38, p. 62.

Lyons a mirror about the size of a two-franc piece, which he described as being very useful for examining the posterior nares and larynx.

In the year 1840,[1] Liston, in treating of œdematous tumors which obstruct the larynx, observed as follows: "The existence of this swelling may often be ascertained by a careful examination with the fingers, and a view of the parts may sometimes be obtained by means of a speculum—such a glass as is used by dentists on a long stalk, previously dipped in hot water, introduced with its reflecting surface downward, and carried well into the fauces."

In the year 1844,[2] Dr. Warden, of Edinburgh, conceived the idea of employing a prism of flint glass for obtaining a view of the larynx.

In the year 1844,[3] Mr. Avery, of London, invented a laryngoscope in principle very similar to that now in use. The reflector was attached to a frontal pad, and was retained in its place by two springs which passed over the operator's head to the occipital protuberance, where there was a counter-pad. There were two defects, however, in Avery's apparatus: the one was, that the laryngeal mirror (instead of being fixed to a slender shank) was placed at the end of a speculum; the other, that instead of employing the reflector for receiving the rays from a lamp placed on the table or elsewhere, Avery used his large circular mirror for the purpose of increasing the luminous power of a candle held near the patient's mouth.

In the laryngoscope of Bozzini and Avery the lamp and the reflector are combined, whilst in the modern instrument they are separate. The laryngeal mirror of Bozzini and Avery was placed at the end of a speculum: Czermak's was a modification of the dentist's mirror. Mr. Avery's invention was not placed on record till some time after the modern laryngoscope had come into use.

In the year 1854,[4] "the idea of employing mirrors for studying the interior of the larynx during singing" occurred to Signor Manuel Garcia. He had often thought of it before, but, believing it impracticable, had never attempted to realize the idea. The efforts of Signor Garcia, who was quite unaware that any similar attempts had previously been made in the same direction, were crowned with success, and the following year he presented a paper to the Royal Society of London, entitled "Physiological Observations on the Human Voice."[5] This paper contained an admirable account of the action of the vocal cords during inspiration and vocalization; some very important remarks on the production of sound in the larynx; and some valuable reflections on the formation of chest and falsetto notes. Signor Garcia's laryngoscopic investigations were all made on himself; indeed, he was the first person who conceived the idea of an autoscopic examination. His method consisted in introducing a little mirror, fixed to a long stem, suitably bent, to the top of the pharynx. He

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[1] Practical Surgery, 1840, 3d edition, p. 417.

[2] Royal Scottish Society of Arts. Description, with illustrations, of a Totally Reflecting Prism for Illuminating the Open Cavities of the Body, etc., etc., May, 1844; see also Lond. Med. Gaz., vol. xxiv. p. 256.

[3] Med. Circ., June, 1862, vol. xx.; and Introduction to the Art of Laryngoscopy, by Dr. Yearsley, London, 1862. The instrument is figured on page 24 of my work on The Laryngoscope.

[4] Notice sur l'Invention du Laryngoscope, par Paulin Richard, Paris, 1861; see M. Garcia's letter to Dr. Larrey, dated May 4, 1860 (p. 12 in Richard's pamphlet).

[5] Proc. Royal Society of London, vol. vii. No. 13, 1855; Philosoph. Magazine and Journal of Science, vol. x. p. 218; and Gaz. Hebdom. de Méd. et Chir., Nov. 16, 1855, No. 46.

directed that the person experimented upon should turn toward the sun, so that the luminous rays falling on the little mirror should be reflected into the larynx;[1] but he added in a foot-note, that "if the observer experiments on himself, he ought, by means of a second mirror, to receive the rays of the sun, and direct them on the mirror which is placed against the uvula." Signor Garcia's communication to the Royal Society, though causing little stir at the time, was destined to create a new era in the physiology and pathology of the larynx. Treated with apathy, if not with incredulity, in England, his paper passed into the hands of Dr. Türck, of Vienna, and soon effected a revolution in the investigation and treatment of laryngeal disease.

In the year 1857,[2] during the summer months, Professor Türck, of Vienna, endeavored to employ the laryngeal mirror in the wards of the General Hospital.

In the month of November of the same year,[3] Professor Czermak, of Pesth, commenced to work with one of Dr. Türck's laryngeal mirrors, and in a short time he overcame all difficulties. Artificial light was substituted for the uncertain rays of the sun, the large ophthalmoscopic mirror of Ruete was used for concentrating the luminous rays, and mirrors were made of different sizes. Thus it was that Garcia's re-invention of the laryngeal mirror led Czermak to create the art of laryngoscopy.

The references, in nearly every section of this work, to medical practitioners in Europe and America, will afford evidence as to the great development of this new department of practical medicine in recent times.

The laryngoscope is essentially the laryngeal mirror, but for practical purposes it may be said to consist of two parts: 1st, a small mirror fixed to a long slender shank, which is introduced to the back of the throat; and 2dly, an apparatus or arrangement for throwing a strong light (solar or artificial) on to the small mirror.

The Laryngeal Mirror.—This may be made of polished steel, or of glass backed with amalgam. Though, on theoretical grounds, the steel mirrors give the more perfect image, they so readily become tarnished and rusty from the least moisture, are so immediately spoilt by accidental contact with the medicated solutions used in treating laryngeal disease, and so soon become scratched in cleaning, that they are not found convenient in practice. The glass mirror is generally mounted in German silver; for though the metal is too favorable to the rapid cooling of the mirror, and the consequent deposit of moisture upon it, it is more easy to fix the shank of the instrument to a frame of metal than to any other substance of inferior conducting power. The mirrors should not be more than one-twentieth of an inch in thickness.

The reflecting surface of the laryngeal mirror may vary from half an inch to an inch and a quarter in diameter. It is well to be provided with at least three mirrors, varying in size between the dimensions specified. The largest-sized mirror is called No. 1, the middle-sized one No. 2, and the smallest No. 3.

For ordinary purposes, a No. 2 mirror will be found most convenient.

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[1] It is worthy of note that Garcia never really followed this plan, but, in point of fact, always used a second mirror for throwing the solar rays on to the laryngeal mirror. In the mirror which he used as a reflector, he also saw the autoscopic image.

[2] Zeitschrift der Ges. der Aerzte zu Wien, April 26, 1858.

[3] Wien. Medizin. Wochenschrift, March, 1858; and Physiolog. Unters. mit Garcia's Kehlkopfspiegel, mit iii. Tafeln. Sitzber. der k.k. Akademie Wiss. in Wien, vom 29 April, bd. xxix. p. 557. (Afterward reprinted in a separate form.)

It may be of square, circular, or oval shape. The circular mirrors cause least irritation, except when enlarged tonsils are present, in which case the oval mirrors are most suitable. The shank of the mirror should be of German silver; it ought to be about four inches in length, and one-tenth of an inch in thickness, and should be soldered to the back of the mirror, so that the latter forms with it an angle of about 120 deg. The handle should be about three inches in length, and rather more than a quarter of an inch in thickness. The shank or stem of the mirror is sometimes, for the sake of portability, made to slide into a hollow wooden handle, and is fixed there by a screw, as is shown in the annexed drawing (Fig. 12, B). The little screw referred to is, however, apt to get loose, and if the stem is made movable, it should be screwed into the handle—the end of the stem itself forming the screw. It is better, perhaps, to have the stem immovably fixed to the handle, as firmness is thereby ensured.

Arrangements for Reflecting the Light.—For throwing a light on to the laryngeal mirror, and thus into the larynx, it will be found most convenient to employ a circular mirror about three inches and a half in

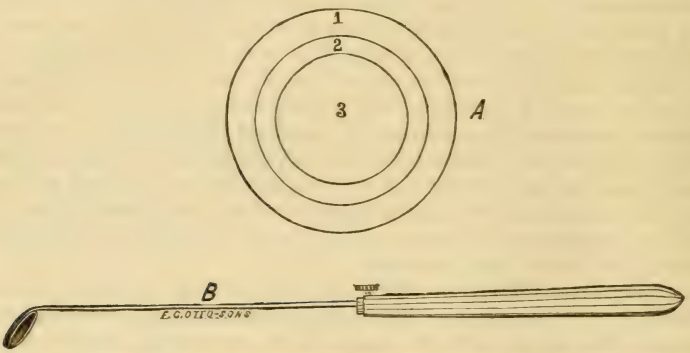

FIG. 12.—The Laryngeal Mirror: *A*, diagram showing the exact sizes of the reflecting surface of the mirrors Nos. 1, 2, and 3; *B*, the mirror and holder (half-size) seen in profile.

diameter, with a small hole in the centre.[1] When artificial light or diffused daylight is employed, the mirror should be slightly concave, and have a focal distance of about fourteen inches; but when solar light is made use of, the surface of the mirror should be plane. The mirror may be attached in some way to the operator's head, or fixed to a horizontal arm, which is connected with the body of the lamp (Tobold).[2] The former plan is by far the most convenient, and the mirror may be worn either opposite one of the eyes (Czermak),[3] in front of the nose and mouth (Bruns),[4] or on the forehead (Fournié,[5] Johnson,[6] etc.). Of these positions, the first is, on theoretical grounds, the most perfect; the last the easiest in practice. The plan of looking through the hole of the reflector offers the great advantage of entirely protecting the observer's eyes from the glare of the light; for whilst the luminous rays necessarily fall obliquely

[1] The reflector should not merely be left unsilvered in the centre, but should be actually perforated; otherwise the glass makes a slight focal inequality between the two eyes. Laryngoscopes, made in every respect according to my directions, are sold by Messrs. Mayer & Meltzer, 71 Great Portland Street.

[2] Laryngoscopie, etc., Berlin, 1874, p. 19.

[3] Loc. cit.

[4] Die Laryngoscopie, Tübingen, 1873.

[5] Loc. cit.

[6] Lectures on the Laryngoscope, 1864.

on the mirror, and therefore do not reach the pupil of the eye immediately behind it, the other eye is also within the shadow of the reflector. It is only in the first position, moreover, that the observer can look through the hole in the reflector; if, therefore, either of the other methods is practised, the reflector need not be perforated. The reflector may be attached to the operator's head, either by a spectacle-frame (Semeleder),[1] or by a frontal band, as recommended by Kramer, and first employed by Bruns.[2] The spectacle-frame, with the upper halves of the rim removed (as seen in Fig. 13), is the arrangement which I have found most convenient. In either case the mirror should be connected with its support by a ball-and-socket joint. The hole in the centre of the reflector should be oblong, and when placed in front of the eye, its long diameter should correspond with the long diameter of the eye. A hole of this shape allows for the varying distance between the nose and eyes in different people, and for the varying position of the centre of the reflector, in its

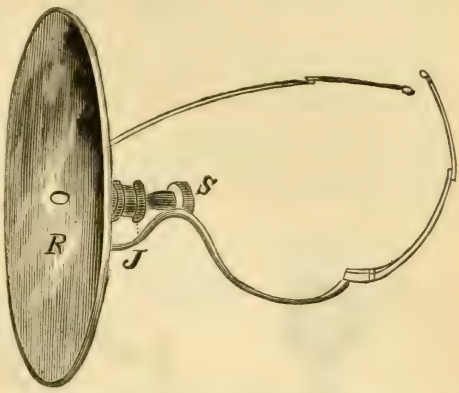

FIG. 13.—Reflector attached to spectacle-frame, from which the upper halves of the rims have been removed. At the back of the reflector (*R*) is a small cup, into which a ball connected with the spectacle-frame fits. A ring is screwed over the ball, and the joint is thus formed at (*J*).

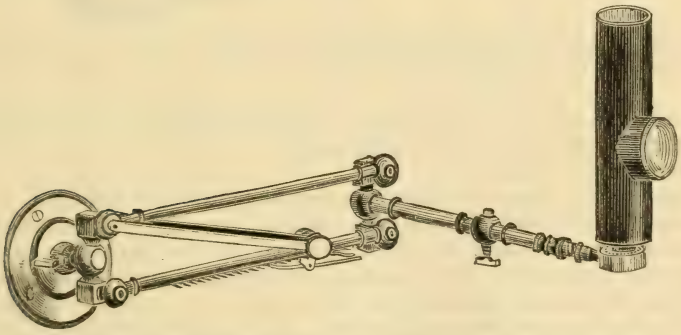

FIG. 14.—The Author's Rack-Movement Lamp. The chimney of the lamp is made of metal, a round hole being left where the lens fits in.

different degrees of inclination. Practitioners who labor under defective vision will find it convenient to have suitable glasses fitted to the spectacle-frame of the frontal reflector.

Illumination.—Any lamp that gives a bright steady light answers the purpose perfectly well. Many of the most valuable observations have been made with a common "moderator." An argand gas-burner will be found very convenient, especially if constructed on the reading-lamp principle, so that it can be fixed at different heights. My rack-movement

[1] Die Laryngoscopie, etc., Wien, 1863, p. 13.

[2] Loc. cit. p. 22.

laryngoscopic lamp, which readily admits of perpendicular and horizontal movement, will be found to greatly facilitate the management of the light. Its action is shown in Fig. 14. The power of the light is increased by a lens placed in front of the flame. My lamp is now used in nearly every hospital in this country where laryngoscopy is systematically employed.

For use at the bedside, where gas is not at hand, my new clinical lamp will be found very serviceable. It has the same action as the rack-movement lamp, but paraffin is used for illumination instead of gas. It makes a very useful lamp for the consulting-room. By reference to the wood-cut (Fig. 15), it will be seen that the base of the apparatus can be hooked on to the bar of a bed, and that the perpendicular stem rotates,

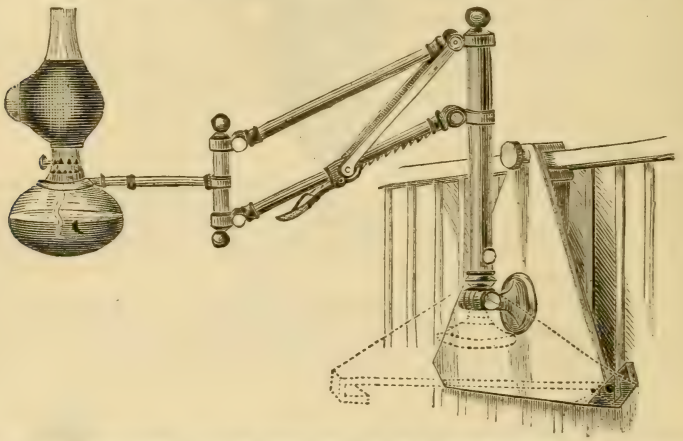

FIG. 15.—The Clinical Lamp. In the illustration, the lamp is seen hooked on to the horizontal bar of a bed; the dotted lines show the position of the base when the lamp is standing on a table.

so as to adapt itself to this position. On the other hand, when in use on the table, the stem can be easily adapted to the upright position, by means of the screw at its foot.

In the various lamps or lanterns recommended by different foreign laryngoscopists (Tobold,[1] Moura-Bourouillou,[2] etc., etc.), the arrangement of lenses in each of them is only applicable to the particular lamp for which it was contrived. This serious objection to the various kinds of illuminating apparatus hitherto in vogue, led me to contrive a light-concentrator of more extensive application. It not only gives a very brilliant light, but is at the same time much smaller, and therefore much more portable than any of those hitherto in use, and it can be employed with any kind of lamp, or even a candle. It consists of a small metal cylinder, three and a half inches long, and two and a half in diameter. This is closed at one end, and at the other there is a plano-convex lens, the plane surface of which is next the flame. The lens is two and a half inches in diameter, and is about one-third of a sphere. In the upper and under surfaces of the cylinder (opposite each other) are two round apertures, two inches and a quarter in diameter. These holes are not equidistant from the two ends of the tube, but so near to the closed extremity that a line passing perpendicularly through their centres would be about

[1] Loc. cit. p. 19.

[2] Traité pratique de laryngoscopie, etc., Paris, 1864.

two inches and a half from the plane surface of the lens, and rays of light pass through in comparatively parallel directions. At the lower part of the tube are two semicircular arms, which, by means of a screw at the side, can be made to grasp tightly the largest lamp-chimney, an ordinary candle, or even the narrow stem of a single gas-jet. The practitioner, therefore, who, in visiting patients, carries my light-concentrator, can always feel certain of being able to illuminate the fauces. The apparatus is passed over the chimney, till the centre of the lens is opposite the most brilliant part of the flame, and then, by a few turns of the screw, the concentrator is fixed in position. When a candle is employed, the flame is in the centre of the tube.

In the side of the tube near the lens are two ivory knobs covered with cork, which enable the practitioner to hold the concentrator and remove it from the lamp, even when it is extremely hot. For the consulting-room the light-concentrator may be most advantageously employed either with an argand gas-burner, a paraffin, moderator, or reading lamp. The latter kind of lamp, with an argand gas-burner, will be found convenient, though my rack-movement laryngoscopic lamp is the best that can be employed.

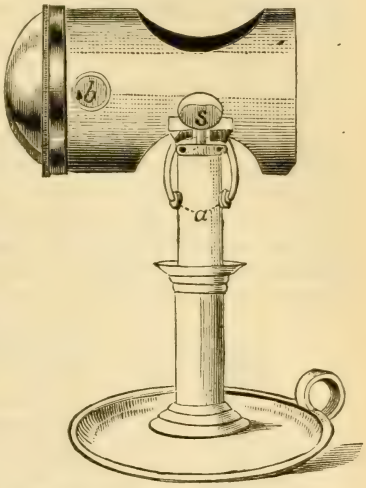

FIG. 16.—The Light-Concentrator. In the drawing, the concentrator is fixed on to a candle by means of two arms (*a*). In using a lamp, the arms embrace the chimney: *s*, screw for tightening the arms; *b*, one of the cork knobs for taking hold of the concentrator when hot.

The light of a candle, strengthened by this concentrator, will be found to equal that given by an ordinary lamp. When the practitioner has only a centre gaselier at his command, the light-concentrator should be applied to the only jet which is lighted; and as it is not generally possible to pull a gaselier sufficiently low down to make the examination in the ordinary way, under these circumstances both patient and practitioner must stand upright.

Besides the concentrator just described, I have had a smaller illuminating apparatus constructed, which is called my "miniature light-concentrator." The principle is the same in both; but in the latter the metal cylinder is only two inches in length, and an inch and a half in diameter: it is only suited for the small paraffin lamp, which is sold with it. This lamp, which measures only four inches from its foot to the top of the chimney, is like a little vial, and has a metal screw stopper, so that it can be carried about with safety.

It has been already observed that the employment of a reflector is not absolutely necessary for throwing a light on to the laryngeal mirror. The solar rays, or diffused light, on a bright day, may be concentrated on the laryngeal mirror. In the former case, the surface of the reflector must be plane; in the latter, the usual concave mirror may be used. The patient should sit with his back turned obliquely to the window, and the practitioner opposite him. The sunlight in this way passes over the patient's shoulder to the reflector, and is thence projected on to the laryngeal mirror. In other respects the examination is conducted in the same way as when artificial light is used.

When the observer does not make use of a reflector, the rays of light must be thrown from a lamp directly into the patient's mouth, or else the luminous rays must be projected from a light in less close proximity by a lens placed in front of the flame. In using an ordinary lamp for direct illumination, either a common plano-convex lens may be used, or a large glass globe about six inches in diameter, filled with water. The latter kind of concentrator (the so-called Schusterkugel) was first recommended by Türck,[1] and afterward adopted by Stoerk; but, whilst the former soon abandoned its use in favor of the reflector, the latter still employs it almost invariably. This apparatus has been further improved by Dr. Walker, of Peterborough. It gives a brilliant light, which is most intense at about twenty inches from the globe. As it is quite impossible to carry this enormous glass globe about, its use is necessarily confined to the practitioner's consulting-room.

A much more convenient plan is that adopted by several of the French physicians, which may be thus described: A lamp provided with a lens is placed on a table so narrow, that the laryngeal mirror can be used by the practitioner on a patient sitting on the opposite side of the table. A shade screens the light from the observer's eyes, whose face, in this mode of examination, is close to the lamp. In applying remedies, the lamp is between the arms of the practitioner, who, as it were, embraces it. Dr. Fauvel, of Paris, uses a table about three feet long and one foot broad, in three leaves; the centre leaf, on which a moderator lamp rests, can be screwed up and down to different heights for different patients. Dr. Krishaber[2] employs a simple round table of small dimensions.

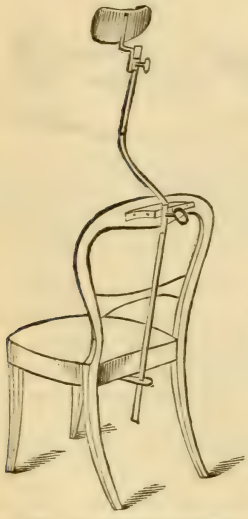

FIG. 17.—The Head-rest.

For direct illumination the oxy-hydrogen lime light is by far the best that has yet been invented, and is especially adapted for demonstrations of cases to a number of persons. Not only is the light superb, but the mode of illuminating is much less fatiguing to the operator when a large number of cases have to be seen, and the heat, if not actually less, is less felt on account of its being further removed from him.[3]

Magnifying Instruments. — Various instruments have been invented for increasing the size of the laryngeal image, but they are of no use in the treatment of disease. As early as 1859, Dr. Wertheim, of Vienna, recommended concave laryngeal mirrors for this purpose; and later, Dr. Türck,[4] calling attention to the fact that the laryngeal image is made up of a number of parts at different distances, suggested the use of a small telescope which he had fitted to his illuminating apparatus. Finally, Voltolini[5] made some further improvements in the apparatus.

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[1] Zeitschrift der Gesellschaft der Aerzte, Nro. 8, 1859, und Allgem. Wien. Med. Zeitung, Nro. 15, 1859.

[2] Dict. Encyclop. des Sciences Médicales, Paris, 1868.

[3] A full description and illustration of this method of illumination will be found in my work on The Laryngoscope, 3d edition, p. 46.

[4] Klinik der Krankheiten des Kehlkopfs, etc., p. 137, Wien, 1866.

[5] Galvano caustik, p. 93.

Micrometers.—For measuring the exact size of different parts of the larynx, and for estimating distances, Merkel,[1] of Leipzig, and Mandl,[2] of Paris, have suggested the plan of having a scale scratched on the laryngeal mirror. Dr. Semeleder[3] objected to this mode of measuring, as it takes so much away from the reflecting surface of the mirror, and recommended that the scale should be drawn on the frame of the mirror. Though these scales might, perhaps, be advantageously employed for physiological investigations, they are of no use to the medical practitioner.

Laryngoscopic Chairs, Head-rests, etc.—Most people, when they are about to have the throat examined, lean back in the chair, throw up the head, and open the mouth. This attitude, however, is very ill suited for laryngoscopy, where both the head and body should be kept erect. In many cases also—especially where the patient is at all nervous—in applying remedies to, or operating on, the larynx, it is very desirable to be able to steady the head. I now use in private practice a narrow-seated high-backed chair (Fig. 21). The seat measures only a foot in depth, and the back is thirty-four inches high. This kind of chair obliges the patient to sit upright, and greatly assists in steadying the head. I formerly employed a head-rest (Fig. 17), very much like that employed by photographers, except that instead of having a stand of its own, it is fixed to an ordinary chair. A strong metal plate, terminating in a ring behind, is screwed to the under surface of the frame which supports the seat; and another similar projecting ring is screwed to the top bar of the chair. A strong iron bar passes perpendicularly through these rings; just above the upper ring it bends obliquely forward for about half a foot, and then again passes perpendicularly upward for another foot. This bend in the bar prevents the patient leaning back. Sliding on the perpendicular bar, is a broad, curved, semicircular pad, which supports the head, and can be fixed at any height.

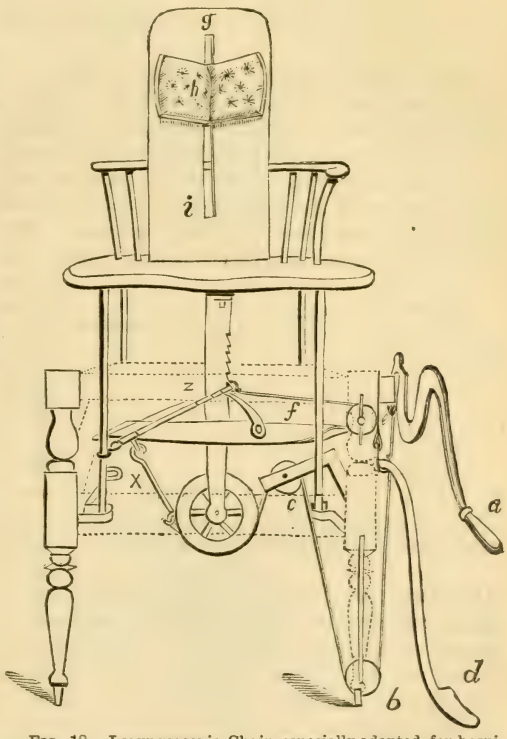

FIG. 18.—Laryngoscopic Chair, especially adapted for hospital purposes. At *a* a lever of the second kind is brought into play through *b* and *c*, the fulcrum being at *x*. By pressing on the handle *a*, the patient is at once raised to the desired elevation. On the other hand, by pressing on *d* with the foot, the operator withdraws the bolt *f* from the rack *z*, and the chair gradually descends. There is a narrow back-board (*g*) with a movable head-rest (*h*), which slides up and down the groove (*i*), and can be fixed at any height by a screw at the back.

[1] Die Funktionen des menschlichen Schlund—u. Kehlkopfes, p. 5, Leipzig, 1862.
[2] Traité pratique des Maladies du Larynx, etc., p. 115, Paris, 1872.
[3] Loc. cit. p. 27.

It allows the patient to raise his head, but prevents any movement backward or laterally. The apparatus is not unsightly, if the metal part is made of brass; and when the support is not required, the perpendicular bar and head-rest can be altogether put away.

For hospital practice, and especially when the oxy-hydrogen light is used, the laryngoscopic chair represented in Fig. 18 will be found the most convenient. It enables the operator to raise or lower the patient without rising from his seat.

LARYNGOSCOPY.

THE only principle concerned in the art of laryngoscopy is the optical law, that when rays of light fall on a plane surface, the angle of reflection is equal to the angle of incidence. A small mirror is placed at the back of the throat, at such an inclination that luminous rays falling on it are projected into the cavity of the larynx; at the same time the image of the interior of the larynx (lighted up by the luminous rays) is formed on the mirror, and seen by the observer. The mirror is held obliquely, so that it forms an angle of rather more than 45° with the horizon. The plane of the laryngeal aperture (bounded by the epiglottis, the ary-epiglottic folds, and the arytenoid cartilages), is also oblique, the epiglottis being higher than the apex of the arytenoid cartilage.

FIG. 19.—Diagram showing the relative positions of the planes of the larynx and laryngeal aperture.

The annexed diagram shows the position of the different parts, and explains their reflection. Let *m* represent the plane of the laryngeal mirror, *l* the plane of the upper opening of the larynx, and *o* the observer. In the plane of the larynx, *a* represents the arytenoid cartilages, *ae* the ary-epiglottic folds, and *e* the epiglottis; the rays from these parts impinge on the mirror, as *á*, *aé*, and *é*, and are thence reflected to the observer at *o*. Thus the epiglottis, which is really the highest in the throat, appears at the upper part of the mirror, the ary-epiglottic folds appear rather lower and at each side of the mirror, whilst at the lower part of the mirror are the arytenoid cartilages. These remarks apply to the vertical reflection.

The only inversion which takes place in the formation of the image is in the antero-posterior direction; the part which in reality is nearest to the observer, the anterior commissure of the vocal cords (*ac* in B, Fig. 20), becomes furthest in the image (*ac* in A, Fig. 17), and the posterior commissure, *pc*, which, in reality, is farthest from the observer, becomes nearest in the image.[1] The symmetrical character of the image, which makes it impossible to judge of right and left, and this antero-posterior

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[1] This is in accordance with the fundamental optical law: That if a diverging pencil of light fall upon a plane reflecting surface, the focus of the reflected pencil will be at the same distance from the surface as that of the incident pencil, but on the opposite side of it.

inversion which actually takes place, often leads people to form erroneous opinions concerning the two sides of the larynx.

The lateral relation of parts in the image must now be considered. The mirror being placed above and *behind* the laryngeal aperture; the rays of light proceeding from the larynx pass directly upward and backward, and the patient's right vocal cord is seen on the left side of the mirror, and the left vocal cord on the right side of the mirror (just as the patient's right hand is opposite the observer's left, and his left hand opposite the observer's right). In the annexed cut (Fig. 20), a wart is seen

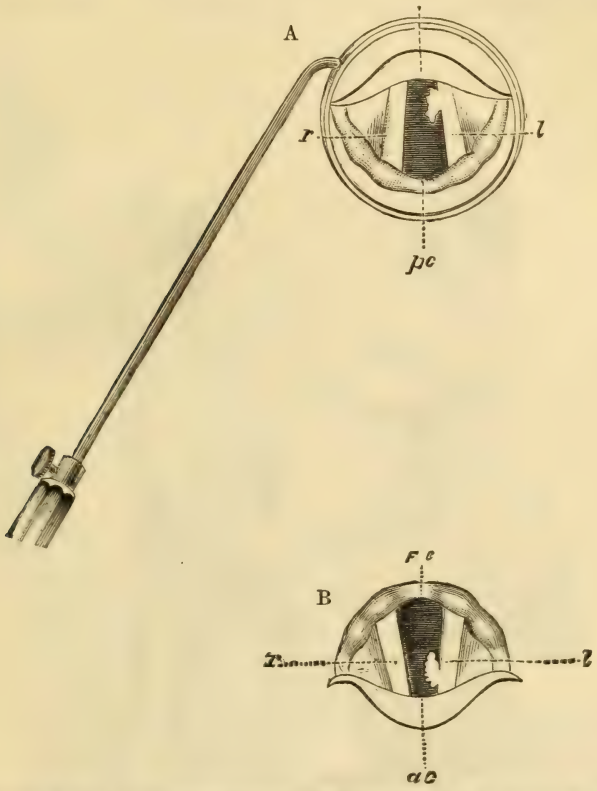

FIG. 20.—Drawing showing the Relation of Parts in the Larynx (B), and the Laryngeal Mirror (A): *ac*, anterior commissure of the vocal cords; *pc*, posterior commissure of the vocal cords; *r*, right vocal cord; *l*, left vocal cord, with a wart on it.

on the left vocal cord of the larynx (B); this is opposite the observer's right hand, and it appears on the same side in the image (A). In consequence, however, of the antero-posterior inversion which takes place as explained in the last paragraph, if the fact that the representation of the larynx (A) is an image is not borne in mind, it would lead to the deceptive idea that the wart was on the right vocal cord. In examining a laryngoscopic drawing, a person must not make his own larynx the mental standard of comparison as regards right and left, but must recollect that the picture represents an image formed on a mirror held obliquely above and rather *behind* the larynx of another person.

In making a laryngoscopic examination there are three stages.

First Stage.—The patient should sit upright, facing the observer, with his head inclined very slightly backward. The observer's eyes should be about one foot distant from the patient's mouth, and a lamp burning with a strong clear light should be placed on a table at the side of the patient, the flame of the lamp being on a level with the patient's eyes. The observer should now put on the spectacle-frame with the reflector attached, and directing the patient to open his mouth widely, should endeavor to throw a disk of light on to the fauces, so that the centre of the disk corresponds with the base of the uvula. If the observer has much trouble in projecting the light on to the fauces, he will find it convenient to incline

FIG. 21.—Laryngoscopy—Third Stage, showing position of practitioner and patient.

the reflector at a suitable angle before putting on the spectacle-frame. This may be done as follows: Taking the spectacle-frame in the hand, with the mirror attached, so that the central aperture in it would come opposite to the pupil of the operator's right eye, and fixing the joint so that the back of the mirror is parallel with the spectacle-frame, the outer edge of the reflector should be pushed rather more than a quarter of an inch forward or backward, according as the lamp is on the right or left side of the patient. If the observer has chosen his position and placed the lamp as directed, on putting on the spectacle-frame, a beautiful lumi-

nous disk will appear at the back of the throat. When direct light is used, the first stage is much simplified, as the patient has only to sit opposite the lens of the lamp, as described at page 165.

Second Stage.—The patient should be directed to put out his tongue, and the observer should hold the protruded organ gently but firmly between the finger and thumb of his left hand, the thumb being above and the finger below. To prevent the tongue slipping, the observer's hand

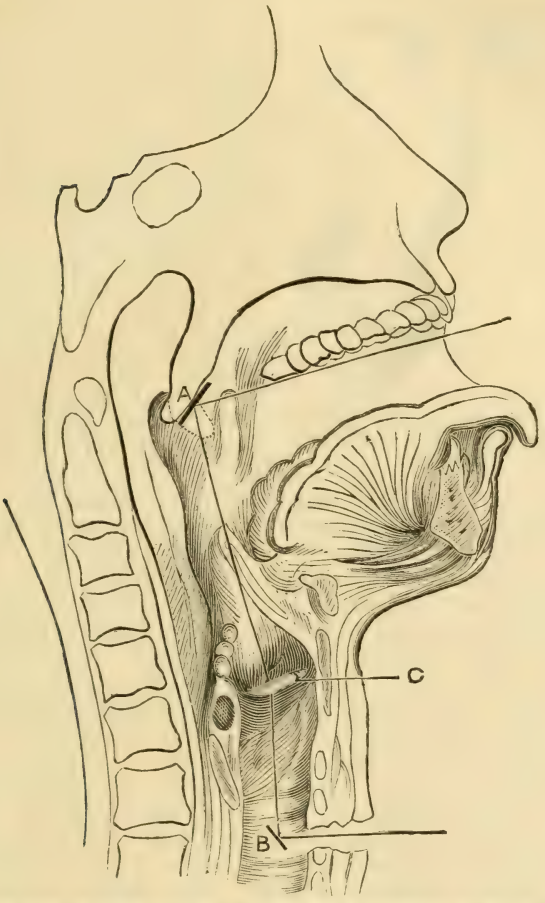

FIG. 22.—Diagram showing the Angles of Incidence and Reflection in Ordinary, and Infra-glottic, Laryngoscopy: A, side view of mirror, when properly introduced. It is seen to push back the uvula toward the posterior nares. B, side view of infra-glottic mirror; C, left vocal cord.

should be previously enveloped in a small soft cloth or towel, and he should be careful to keep his finger rather above the level of the teeth, in order that the frænum may not be torn. The position of the practitioner and patient is shown in Fig. 21. In cases that are likely to require local treatment, the patient should be taught to hold out his own tongue, so that the operator may be able to introduce the mirror with his left hand, whilst with the right he applies the remedy to the affected part.

Third Stage.—When the observer has practised the first two stages, he should take a small laryngeal mirror about half an inch in diameter, and after warming its reflected surface for a few seconds over the chimney of the lamp (to prevent the moisture of the expired air being condensed on it), should introduce it to the back of the throat. In holding a mirror over a lamp, the little glass is first covered with a film of moisture, which quickly clears away. Directly the glass is clear, it is the right temperature—neither too hot nor too cold—to be introduced. Before introducing the mirror, however, lest it should be accidentally too hot, the practitioner should test its temperature by placing it on the back of his hand. Supposing that the various steps already described have been followed, and that there is a steady disk of light on the base of the uvula, the laryngeal mirror should now be introduced; but no attempt should ever be made unless perfect illumination has first been effected. To pass the mirror to the back of the throat with as little annoyance as possible to the patient, the following method should be adopted: The handle of the mirror should be held like a pen in the right hand, and quickly introduced to the back of the throat, its face being directed downward, and kept as far as possible from the tongue in the median line of the mouth (Fig. 23). The posterior surface of the mirror should rest on the uvula, which should be pushed rather upward and backward, toward the posterior nares (Fig. 22). When the mirror has thus been introduced without irritating the fauces, the observer should raise his hand slightly and direct it outward toward the corner of the mouth. This rotatory movement, which alters the inclination of the mirror, and turns its face more toward the perpendicular (whilst the hand is thereby kept entirely out of the line of vision), should be effected rather slowly, so that it can be arrested directly the larynx comes into view. After introducing the mirror, the observer can, if he chooses, steady it, by resting the third and fourth fingers against the patient's cheek. The exact angle which the mirror should bear to the laryngeal aperture must depend on a number of circumstances, such as the degree of flexion backward of the patient's head; the particular angle which the plane of the laryngeal aperture bears to the horizon in the case undergoing inspection; and on the direction which the ray must take to reach the observer's eye—that is to say, on the position of the observer (Fig. 23). The practitioner should learn to introduce the mirror with either hand, for by so doing any false ideas concerning a supposed asymmetrical condition will be at once corrected; and whilst, for the purpose of diagnosis, it is very desirable to be able to use either hand, in the application of remedies to the larynx, ambidexterity is absolutely essential.

FIG. 23.—The Position of the Hand and Mirror, when the latter has been properly introduced for obtaining a view of the larynx.

Beginners, in their anxiety to get a good view, often give rise to faucial irritation, by keeping the mirror too long in the patient's mouth;

but one of the commonest mistakes made by those unpractised in the use of the laryngoscope, consists in introducing the laryngeal mirror before the disk of light has been steadily concentrated on the base of the uvula. The imperfect illumination causes the operator to touch the back of the throat in several places before it is put on the right spot. Again, beginners often lose the light, even after they have thrown the rays in the first instance in the proper direction ; under these circumstances, instead of withdrawing the laryngeal mirror and redirecting the light on to the centre of the fauces, as the skilled laryngoscopist would do, the beginner moves his head (which supports the frontal mirror) in the hope of thus being able to throw the light in the right place, the laryngeal mirror being kept in the meantime in the patient's throat, where it is certain to cause irritation. This is a fatal error. The practitioner should recollect that when an act of retching has once taken place, it is afterward often impossible to get a good view of the larynx at the same sitting. Moreover, the act of retching always causes considerable temporary congestion of the laryngeal mucous membrane, and thus is apt to lead the inexperienced to very erroneous conclusions. It is, therefore, better to introduce the mirror any number of times, keeping it in the throat only for a few seconds each time, than to let it remain longer, and thus limit the examination to one inspection. The novice must be careful to avoid touching the tongue with the mirror, for this procedure irritates the throat, and spoils the reflecting surface of the mirror for the time. This can generally be avoided by keeping the back of the mirror in close proximity to, but not letting it touch, the palate. In some people, however, the uvula is in actual contact with the back of the tongue, and as in inspiration or vocalization the uvula is raised, such persons should be directed to inspire deeply, or to produce some vocal sound (such as "ah," "eh," "oh," etc.) ; the mirror can then be easily slipped in between the uvula and the tongue. All violence or even roughness must be carefully avoided, the tongue must be held out most gently, and the laryngeal mirror placed very lightly on the uvula. Complicated instruments for holding the mouth open almost invariably lead to failure.

Special Difficulties.—The difficulties solely dependent on the practitioner's want of dexterity have been already considered, but a few words must be devoted to those in part due to the patient. The obstacle may be either undue irritability of the fauces, a peculiar action of the tongue, an abnormal size of the tonsils, or a pendent condition of the epiglottis.

As regards faucial irritability, it is to be observed that though this condition sometimes exists of itself, it is far more often caused by the clumsiness or inexperience of the practitioner. Most patients can be examined with facility at the first sitting, and only a small proportion require any training. With timid patients—especially women—on first using the laryngoscope, it is well to place the mirror for a second on the back part of the palate, without being too particular about seeing anything. By introducing the mirror once or twice in this way, the patient's confidence is secured, and a more fruitful examination may afterward be made. For reducing an unusually irritable condition of the fauces, we may have recourse to several expedients, in order to enable the patient to tolerate the introduction of the laryngeal mirror. Bromide of potassium is generally supposed to have the power of producing anæsthesia of the pharynx, but the effects of this drug are too uncertain to meet the wants of the laryngoscopist. The method of frequently painting the mucous membrane with chloroform, ether, or solution of morphia, recommended

by Türck [1] and Schroetter,[2] is tedious and attended with the danger of producing serious general narcotism. Von Bruns [3] advises that the pharynx should be sprayed with a solution of tannin, or pencilled with a mixture of tannin and glycerine. When, however, the practitioner requires to make an immediate inspection of the larynx, his object may almost always be accomplished by directing the patient to suck small pieces of ice continuously for fifteen or twenty minutes. This remedy rarely, if ever, fails to blunt for a short time the ordinary sensitiveness of the mucous membrane. In cases where it is necessary to carry out a prolonged local treatment of the larynx, as in the removal of growths, the patient may be directed to practise on himself daily with the laryngeal mirror.

The conformation of parts occasionally causes some difficulty. Thus, when the tongue is drawn out, it sometimes forms an arched prominence behind, which causes trouble in introducing the mirror, and difficulty in seeing it when *in situ*. This position of the tongue is due to reflex action, and will be best avoided by pulling the tongue less forward than usual, keeping it level with the mouth (that is to say, not holding it down toward the chin), and by cautioning the patient not to strain.

Enlarged tonsils sometimes embarrass the operator. In this condition a small oval mirror should be used. An unusually large or pendent epiglottis causes a more serious impediment to laryngoscopy. When the valve is very large, it sometimes shuts out the view of the larynx; but the same result is more often caused by unusual length or relaxation of the glosso-epiglottic ligaments. In the production of high (falsetto) notes, the epiglottis is generally raised, and this also happens when a person laughs; the observer will, therefore, do well to take advantage of these physiological facts. In a certain number of cases, however, the epiglottis remains obstinately pendent. For elevating the valve in these cases, various instruments have been invented, but they seldom prove of any service. Some of the German laryngoscopists recommend that a thread should be passed with a curved needle through the epiglottis. An assistant, standing behind the patient, draws the thread over the patient's face and head, or the opposite end of the thread may be tied round the patient's ears. Most of the instruments hitherto invented, however, cause so much irritation that they cannot often be employed with advantage.[4] When the epiglottis covers the larynx in the manner described, the laryngeal mirror should be introduced lower in the fauces, and more perpendicularly than is usually suitable. In almost all cases the arytenoid cartilages, surmounted by the capitula Santorini, can be seen, and from them we can judge with tolerable certainty as to the mobility of the vocal cords; the state of the mucous membrane of the larynx in other parts cannot, however, be safely inferred from the condition of that which covers the arytenoid cartilages.

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[1] Klinik der Krankheiten des Kehlkopfs, Wien, 1866, p. 551 et seq.

[2] Jahresbericht, etc. (op. cit.), 1870, p. 34.

[3] Die Laryngosk. u. die Laryngosk. Chirurgie, Tübingen, 1865, p. 53.

[4] See Türck: Klinik der Kehlkopfskrankheiten, Wien, 1866, p. 551 et seq.; Tobold: Laryngoscopie, Berlin, 1874, p. 449 et seq.; Oertel: Deutsches Archiv für klin. Medicin, vol. xv., Heft 3 and 4; and my work on The Laryngoscope, Third edition, p. 85.

Auto-Laryngoscopy.

Those who desire to acquire dexterity in introducing the mirror at their own expense, rather than that of their patients, and those who wish to demonstrate their larynx to others, should learn to employ the laryngoscope on themselves.

When auto-laryngoscopy is practised, it is requisite that, besides the circular reflector and laryngeal mirror, another mirror should be used: this must be placed in such a position that the image reflected in it from the throat-mirror can be seen by the autoscopist. For practising auto-laryngoscopy, Professor Czermak[1] contrived a special apparatus. It has a large reflector and quadrilateral mirror, each supported on perpendicular bars. These mirrors are fixed about a foot apart, and both can be turned in almost any direction, and fixed at any height. In using this apparatus, the observer should sit at a table with the quadrilateral mirror a few inches in front of his mouth, and the reflector a foot further back, the upper edge of the square mirror being level with the lower edge of the reflector behind it. The flame of the lamp should be near, but a little behind and to the side of, the quadrilateral mirror. The observer now throws the light into his fauces with the reflector, introduces the warmed laryngeal mirror, and sees the image in the quadrilateral glass. People facing the demonstrator can see the image in the laryngeal mirror, and those behind him in the one which he looks at. For those who wish to make accurate physiological observations, this is the best method of practising auto-laryngoscopy. Those who object to purchase a special apparatus can use the ordinary reflector for auto-laryngoscopy. In this case, all that is requisite is a perpendicular telescope-bar, capable of being made about a foot and a half in length, and having a broad firm base: at the top of the bar is a small projecting ball, which fits into the socket at the back of the ordinary reflector. The reflector is placed on a table, at about eighteen inches from the observer, between whom and the reflector there must be a small toilet mirror or hand-glass. In other respects, the examination must be conducted as already described.

A simpler method of practising auto-laryngoscopy is that recommended by Dr. George Johnson.[2] The observer puts on his ordinary reflector, as though he were going to examine a patient, and sits facing a toilet mirror. A lamp is placed on one side of the observer, in a line with the mirror, or slightly behind it, and by manipulating the reflector the observer now throws the light on to the image of his fauces, as seen in the toilet-glass. He then introduces the laryngeal mirror into his throat, and the image of the larynx formed on it is seen in the toilet-glass, both by the demonstrator and by the persons standing behind him. In practising auto-laryngoscopy in this manner, the practitioner has to manage the light in the same way as in examining patients, and he thus learns to overcome one of the difficulties of laryngoscopy. The only disadvantage of this method, as compared with that of Czermak, is that, by it, the rays of light undergo an additional reflection before they reach the larynx, and thus the image is not quite so distinct.

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[1] Loc. cit., pp. 1 and 28 (with illustration).

[2] Loc. cit.

Infra-glottic Laryngoscopy.

Where tracheotomy has been performed, and a fenestrated canula is worn, a very minute mirror may be introduced through the tube with its face directed upward; or the canula may be removed, and the mirror passed into the wound (Fig. 22, p. 171). In this way the observer obtains a view of the larynx from below.

This method was first suggested by Dr. Neudörfer,[1] in 1858, and was first carried out by Professor Czermak[2] in the following year. Since then, various observers have examined patients in this way, and I have myself often had the opportunity of employing the mirror from below. Some interesting observations made by a medical man on himself have been recorded by Dr. Semeleder.[3] This mode of examining the larynx, though of very limited application, is valuable, because it generally happens, in cases where a canula is worn, and air is inspired mainly through the trachea, that the epiglottis does not rise up, but remains pendent, in inspiration; in post-tracheotomy cases, also, it often happens that the epiglottis is bound down over the larynx by old cicatrices, and consequently ordinary laryngoscopy is useless. It is well to remark that the vocal cords, when observed from below, have a reddish color, and do not present the peculiar white appearance which is seen when the laryngeal mirror is placed on the uvula.

THE LARYNGEAL IMAGE.

The rationale of the formation of the image having already been explained (page 168), the special description of its individual parts will be now undertaken. In some cases, on introducing the laryngeal mirror, only the epiglottis may be visible, with perhaps just the tips of the capitula Santorini at the posterior part; whilst in others, the entire length of the vocal cords, the ventricular bands, the small cartilages of Wrisberg and Santorini, a portion of the cricoid cartilage, the rings of the trachea, and perhaps even the bifurcation of the bronchi below it, can be seen with perfect distinctness. The view varies in different cases between these two extremes.

The *epiglottis* varies very much in appearance in different individuals. In some cases it is broad, whilst in others it is extremely narrow; in some only the upper surface can be seen, in others, where the epiglottis is drawn tightly to the tongue, only the under surface is visible. In the centre of the free edge is a slight notch, which gives to the epiglottis, when seen in its entirety, its foliate appearance. But the free edge of the valve is more often turned upon itself, so that in the reflection the notch is lost sight of, and the border appears round. In some cases, on account of the inclination of the epiglottis, only the profile of its free edge is visible in the mirror. In these cases the valve is represented by a thin line. As a rule, there is seen (Figs. 24 and 25)—1st, A portion of its upper surface on either side (*u*); 2dly, its free edge and a small portion of its under surface turned up in the centre, and forming a kind of

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[1] Oesterreich. Zeitschrift für pract. Heilkunde, 1858, Nro. 46.
[2] Wiener Med. Wochenschrift, 1859, Nro. 11.
[3] Loc. cit. p. 24.

lip (*l*) ; and 3dly, another portion of its under surface, below and behind the lip, projecting as a rounded prominence—the cushion (*c*). The upper surface is of a dull pinkish hue; the lip is of a decided yellow color, though it has a slight shade of pink; and the cushion is invariably bright red. In some cases the whole of the under surface of the epiglottis is seen, and then it is of a bright red color. This normal coloration of the under surface of the epiglottis is apt to be mistaken (by those unaccustomed to the use of the laryngoscope) for congestion of the mucous membrane. Above the epiglottis, the glosso-epiglottic folds (*ge*) may be seen, passing upward and backward to the tongue, the posterior superior border of which appears as a horizontal uneven line.

The *ary-epiglottic folds* (*ae*) which form the lateral boundaries of the upper laryngeal aperture, can be seen in the mirror extending obliquely downward and backward from the epiglottis to the arytenoid cartilages. Near the latter are the slight pinkish prominences of the *cartilages of Wrisberg* (*cW*), and a little beyond the cartilages of Wrisberg, in the same fold of mucous membrane, are two other small prominences, the *capitula Santorini* (*cS*), surmounting the arytenoid cartilages.

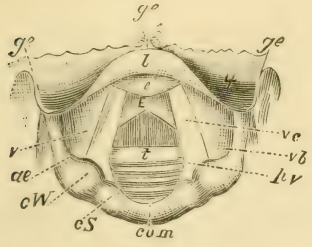

Fig. 24.

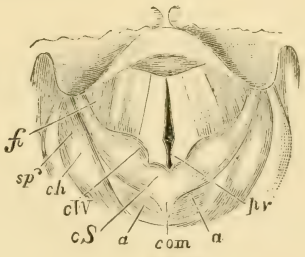

Fig. 25.

Fig. 24.—Laryngoscopic Drawing, showing the Vocal Cords drawn widely apart, and the Position of the various Parts Above and Below the Glottis, during Quiet Inspiration: *ge*, glosso-epiglottic folds; *u*, upper surface of epiglottis; *l*, lip of epiglottis; *c*, cushion of epiglottis; *v*, ventricle of larynx; *ae*, ary-epiglottic fold; *cW*, cartilage of Wrisberg; *cS*, capitulum Santorini; *com*, arytenoid commissure; *vc*, vocal cord; *vb*, ventricular band; *pv*, processus vocalis; *cr*, cricoid cartilage; *t*, rings of trachea.

Fig. 25.—Laryngoscopic Drawing, showing the Approximation of the Vocal Cords, and the Position of the various Parts in the Act of Vocalization: *fi*, fossa innominata; *sp*, sinus pyriformis; *ch*, cornu of hyoid bone; *cW*, cartilage of Wrisberg; *cS*, capitulum Santorini; *a*, arytenoid cartilages; *com*, arytenoid commissure; *pv*, processus vocalis.

The *cartilages of Wrisberg* generally appear round, but sometimes, especially in thin people, they have a triangular shape—the apex of the triangle being directed outward. The capitula Santorini have a roundish shape in the healthy larynx, and like the cartilages of Wrisberg are most distinct when the vocal cords are approximated. But the clearness with which these small laryngeal cartilages can be seen, depends also upon their degree of development, and upon the amount of submucous areolar tissue surrounding them; sometimes the cartilage of Wrisberg is not to be seen at all, whilst occasionally there is a small cartilage between it and the capitulum Santorini. The breadth of the ary-epiglottic folds varies in different people and in different states of the larynx, being greater when they are relaxed, that is, in inspiration, and narrow when they are tense, as in the approximation of the cords—especially in the production of high notes. The ary-epiglottic folds have been well described by Stoerk, as having almost the same color as the gums. The cartilages of Wrisberg and Santorini are of a rather brighter and deeper color than the rest of the mucous membrane.

The *arytenoid cartilages* (*a*) are easily recognized by the small cartilages of Santorini which surmount them. They can be best seen when the vocal cords are approximated. The mucous membrane covering them is generally of a rather redder tinge than that forming the ary-epiglottic folds. Between the arytenoid cartilages is a fold of mucous membrane, the inter-arytenoid fold or commissure, which is most apparent when the glottis is widely open (Fig. 24, *com*); when the arytenoid cartilages are approximated, the commissure folds together, and is directed backward (Fig. 25, *com*). It is of a yellowish pink color.

The *ventricular bands* (*vb*), formerly called the false vocal cords, are the folds of mucous membrane which are seen below the ary-epiglottic folds, passing obliquely in the antero-posterior diameter of the larynx, from the arytenoid cartilages to the epiglottis. They are thick, rather prominent, and of a deeper red color than the ary-epiglottic folds. Being rather thinner, and more prominent at their lower edge (which borders on the ventricle) than elsewhere, this part has a lighter tint when illuminated than the rest of the ligament. When the vocal cords are approximated a small depression—the fossa innominata (*fi*)—may be seen near the epiglottis between the ventricular bands below and the ary-epiglottic folds above.

The openings of the ventricles (*v*) can sometimes be distinguished as dark lines, between the ventricular bands and vocal cords. They are best seen in the healthy larynx of a thin subject—especially when there is a slight disposition to spasm.

The *vocal cords* (*vc*) when visible, cannot be mistaken. They appear as two pearly white cords, passing from the base of the arytenoid cartilages to the angle of the thyroid cartilage. On inspiration, they appear almost to touch each other at their anterior insertion, but to be separated from a quarter to half an inch posteriorly. On phonation, they become parallel, and appear to approximate. Each vocal cord is seen to terminate behind in the angle at the base of the arytenoid cartilage, called the vocal process (*vp*). On inspiration, this angle is directed outward, and the glottis has a lozenge-shape; but when the vocal cords approach one another, the angle is turned inward. This process divides the intercartilaginous and interligamentous portions of the glottis.

Below the vocal cords, appears the broad yellow *cricoid cartilage* (*cr*), and below it, again, the rings of the trachea (*t*) are seen elevating the mucous membrane, which between them is of a pale pink color. Occasionally, two indistinct dark circles (the openings of the bronchi), on either side of a bright projecting line (the angle of division between the bronchi), indicate the bifurcation of the trachea, and in some rare cases, a ray of light may even be thrown down the right bronchus.

Though external to the larynx, it is necessary to mention the *sinus pyriformis* (*sp*) in which foreign bodies are extremely likely to become lodged. It is bounded on the inner side by the ary-epiglottic folds, and on the outes side by the inner surface of the thyroid cartilage.

LARYNGEAL INSTRUMENTS.

In operating within the larynx the laryngeal mirror should be held in the left hand, and the instrument in the right. It is seldom necessary to employ an assistant to steady the head, except in the case of very young

children. Before describing the various instruments in detail, I may observe that whilst most Continental practitioners, as a rule, use laryngeal instruments curved like a catheter, from the first I employed those of a more angular form, and this type is universally used in England, and pretty generally in America. In a catheter the two extremities are at right angles to each other; but the angle is reduced to a minimum by a large curve or sweep. This curve, though well adapted for the urethra, is much less suitable for the larynx; and if, on the other hand, the right angle, slightly smoothed down, is left, the instrument in passing into the larynx is kept free of the epiglottis. My meaning will be at once clear

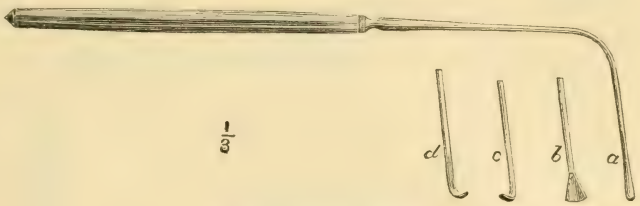

Fig. 26.—Laryngeal Probes.

on reference to Fig. 44. It will be seen that both the catheter-curved instrument (indicated by dotted lines), and my rectangular instrument reach the same spot; but whilst the former touches, and even presses against the epiglottis, the latter avoids it. Hence the superiority of the rectangular instrument.

Probes.—It occasionally happens that it is desirable to introduce sounds within the larynx. By means of such instruments the origin and density of a growth may sometimes be ascertained, when with the unaided laryngeal mirror the information cannot be obtained. In cases of ulcera-

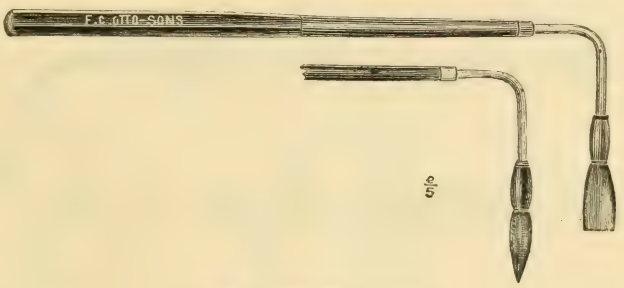

Fig. 27.—Laryngeal Brushes.

tion over the arytenoid cartilages they often enable the practitioner to ascertain the extent of the burrowing and the condition of the cartilages themselves. In cases of altered sensibility of the larynx, relative differences may be ascertained.

Brushes.—For applying solutions to the larynx, squirrel's or camel's-hair pencils, either cut square at the end or pointed, according as a large surface or small spot has to be touched, and firmly attached to aluminium wire bent at an angle of about 90°, will be found most suitable. Brushes of different lengths and sizes are required, according to the situation and nature of the case. For ordinary use, three brushes will be sufficient, and

these are made of definite dimensions. The shortest size (No. 1) measures two inches in length from the angle to the end of the brush. The length in the medium size (No. 2) from the angle is two inches and a half. In the longest (No. 3) the length is three inches. In all cases the metal shank of the instrument between the handle and the angle should measure at least an inch, and the wooden handle about seven inches. The handle should be octagonal, and should taper down toward the metal ;

Fig. 28.—The Croup-Brush.

and in hospital practice, or where a large number of cases are seen, it saves a good deal of trouble in sorting and selecting to have the handles of brushes Nos. 1, 2, and 3, colored, white, red, and black respectively. The Croup-Brush (Fig. 28) is made of squirrel's tail, and the hairs *covering the sides of the brush* are directed *upward*. It is mainly useful for

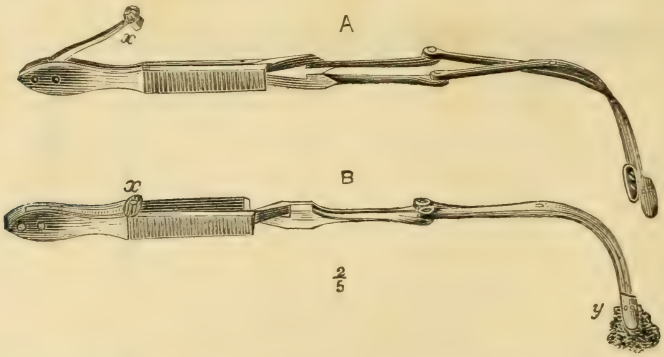

Fig. 29.—The Sponge-Holder: A, the holder open ; B, the holder with sponges. (The safety-wedge (*x*, is raised in A, but closed in B.)

detaching false membrane from the larynx and trachea in croup, but it may be employed for applying remedies in the case of children—when the laryngoscope cannot be used.

Sponges were at one time much used by Dr. Fauvel, of Paris, for applying solutions to the larynx, and they possess the advantage that a perfectly new sponge can be used for each patient at every visit. I have lately employed a very excellent American sponge-holder in this way,

after having slightly modified the instrument in order to make it quite safe. To prevent the possibility of the sponge dropping, I have added a wedge, which fixes the blades of the sponge-holder immovably together. Dr. P. C. Smyly, of Dublin, uses cotton wool attached to a piece of bent aluminium wire by means of strong thread; the instrument is thrown aside after being once used, and fitted with a fresh piece of wool for each occasion.

Laryngeal Injectors.—Various kinds of syringes have been invented for injecting fluids into the laryngeal cavity. I do not recommend this method of treatment, but those who wish to practise it will find Hartewelt's

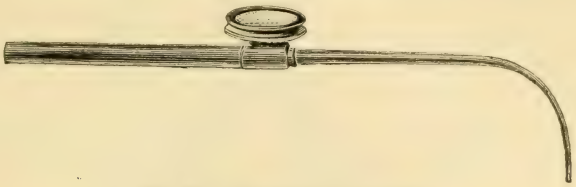

Fig. 30.—Hartewelt's Drop Injector.

Drop Injector (Fig. 30) a very manageable instrument. It is a hollow tube made of vulcanite, and suitably curved for introduction into the larynx. At the junction of the shank and the handle, on the upper part of the instrument, is a small cavity covered with a drum-like piece of caoutchouc and communicating with the interior of the tube. The injector is filled by pressing the air out of the cavity, and inserting the point

Fig. 31.—Professor Siegle's Inhaler.

of the instrument into the solution to be used. This instrument is made in two parts, so that the same handle can be employed with different tubes, and the points of the tubes are also made in different ways, some having a number of small holes, so that the stream is diffused; while some have only a hole at one side, so that the fluid passes only in one

direction, etc., etc. The injector is held between the thumb and second finger, and the index finger remains free to press on the elastic drum when the point of the instrument has been passed into the larynx. The late Dr. Gibb used a small syringe with a fine curved silver extremity, terminating in a small, finely perforated ball, by which showers of "the solution were distributed through the larynx." The principal objection to the use of injectors is that they have a tendency to cause more spasm than brushes, and with them it is more difficult to limit the amount of the application, or to confine it to certain spots.

Inhalers.—For the application of liquids to the larynx, in the form of a very fine spray, many kinds of "atomizers" have been invented; but Bergson's tubes have, in point of fact, superseded all others. These are applied in Dr. Andrew Clark's handball Spray-Producer, in which an india-rubber ball supplies air as the motive power, and in Professor Siegle's apparatus (Fig. 31), in which the atomization of the fluid is effected by steam; both are good instruments. The ordinary handball Spray-Producer is so well known that it does not require to be illustrated. Dr. Solis Cohen's Spray-Producer, in which only a single ball is used, is an extremely useful instrument. There is no advantage in having a *continu-*

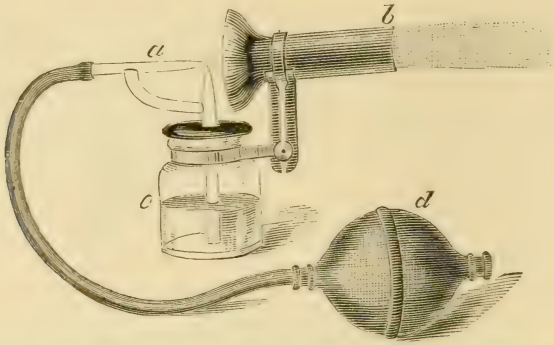

FIG. 32.—Dr. Solis Cohen's Single-Ball Atomizer: *a*, glass points at right angles; *b*, vulcanite tube for preventing dispersion of spray; *c*, bottle containing medicated fluid; *d*, india-rubber air-ball.

ous spray for the throat, as the spray cannot be continuously inhaled. Indeed, it is more convenient to have the spray *interrupted*, as it can then be easily drawn in at each inspiration, and does not continue to flow during expiration and periods of rest. These instruments certainly produce a finer spray than those in which the fluid is pulverized by being projected in a fine jet against a disk or button; but they are open to the serious objection, that in all cases a very strong current of air or steam accompanies the atomized liquid. Where any dyspnœa exists, this is a very objectionable feature. The employment of atomizers in throat affections is more particularly indicated in cases where, from circumstances, the patient cannot visit his medical attendant sufficiently often, and is thus obliged to carry out the treatment himself. I do not recommend the use of these atomizers for the inhalation of caustic solutions.

For the inhalation of volatile medicaments, a supply of steam is all that is required, but the process can be best carried out with the aid of one of the numerous inhalers now in vogue. Those instruments are most effectual in which the patient inhales steam together with air, which is drawn through the hot liquid, and thus becomes thoroughly impregnated

with the active principle of the medicament. In inhaling steam in which there is no such aërial current, the remedy acts much more feebly. The

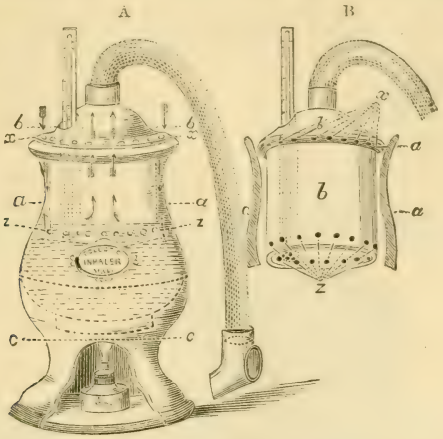

FIG. 33.—The Eclectic Inhaler. The inhaler consists of three parts, *a*, *b*, *c*. *a* is an open vase, and is essentially the containing vessel, into which the hot water and medicated solution are put. It is shown in A with a pint of water in it, and above the water-line is a large space for steam. *b* is a kind of lid resembling an inverted tumbler, which forms the cover of the containing vase. It is seen in its proper position in A, and with the sides of the vase drawn diagrammatically in B. The bottom of the tumbler forms the covering of the vase, and the sides of the tumbler dip down into it, leaving an air-chamber between the two parts. When the vase contains the proper quantity of water, the sides of the inverted tumbler or lid dip down only about half an inch below the water-line. The circumference of the lid is perforated with small holes, as seen in *x*, and the circumference of what would be the rim of the tumbler is perforated in the same way at *z*. The apertures both above and below communicate with the air-chamber. When the patient inhales, air rushes through the various holes above at *x*, then through the air-chamber, again through the series of holes at *z*, and, finally, up to the mouth-piece, as shown by the course of the arrows. In the centre of the upper surface of the lid is a projecting nozzle, to which is attached a flexible tube, provided at its extremity with a double-valve earthenware mouth-piece. There is an opening in the lid, through which a thermometer, registering high temperatures, passes into the water. *c* is a stand on which the vase rests, and is made hollow, so as to hold a spirit lamp.

Eclectic Inhaler (Fig. 33) is perhaps the most perfect of these instruments, but it is rather cumbersome.

Martindale's Portable Inhaler is an excellent apparatus, and fulfils

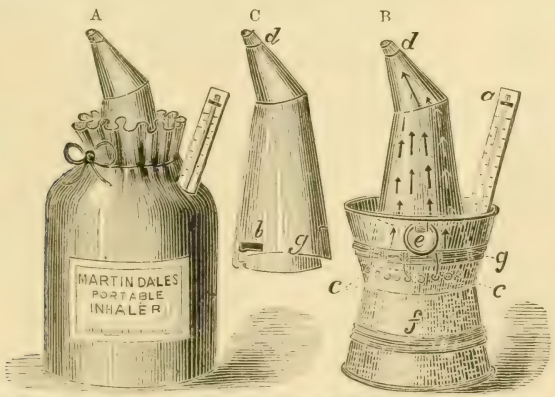

FIG. 34.—Martindale's Portable Inhaler: A shows the inhaler ready for use, with a woollen covering, to prevent rapid cooling; B is the uncovered inhaler; C is its upper portion, which takes off for cleansing the apparatus, and to facilitate the packing.

most of the conditions of the Eclectic Inhaler, whilst it is much cheaper, and, being made of tin, is easily carried about without any risk of breaking.

Bullock's Hospital Inhaler is cheap and serviceable. It is made of stoneware, and has a tin lid and spout, the mouth-piece of which is covered with india-rubber.

Dr. Lee's Steam-draught Inhaler[1] is a very useful instrument, as it

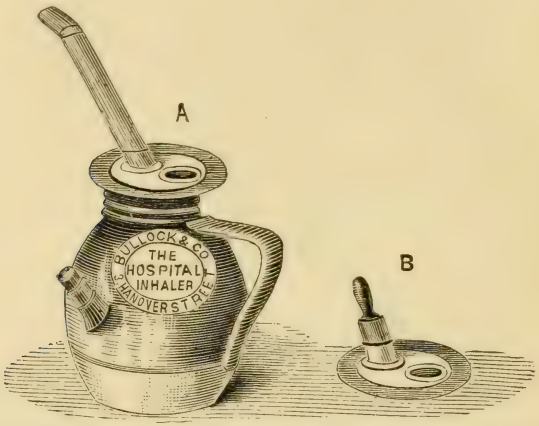

FIG. 35.—Bullock's Hospital Inhaler: A shows the inhaler ready for use; B is the lid with nose-piece for nasal inhalations.

delivers the steam, and thus dispenses with the necessity for an inspiratory effort.

For the inhalation of burning substances, such as nitre, stramonium, arsenic, etc., no apparatus is absolutely necessary, as they can all be employed by merely being lighted on any non-inflammable substance. A special apparatus, however, such as the Fuming-Inhaler, is useful, particularly in employing nitre-papers.

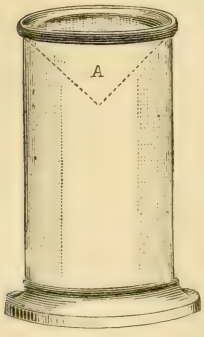

FIG. 36.—The fuming-inhaler. This apparatus consists of a cylindrical earthenware vessel—a vase in fact—four inches high and two inches in diameter. An open wire diaphram occupies the upper part of the cylinder.

Steam Kettles are useful in laryngitis and diphtheria. The best apparatus of this kind is the Ventilating Croup-Kettle, of Messrs. Allen (Fig. 37), which constantly delivers a small quantity of steam in a state of very fine subdivision.

Insufflators.—Powdered substances may be introduced into the larynx either by insufflation or by various kinds of injectors. This plan of treatment is of very ancient origin, having been introduced by Aretæus. The insufflators in use are (1) that of Rauchfuss (Fig. 38), in which the powder is expelled by pressure on an elastic ball at the end of the instrument; and (2) the Tube-Insufflator (Fig. 39). In this instrument a piece of elastic tubing is attached to the proximal extremity of the vulcanite tube. With the free end of the tubing in his mouth, the operator blows the powder into the patient's larynx. This instrument is preferable to that of Rauchfuss, as the sudden pressure of the thumb on the ball of the latter instrument alters the direction of the point of the injector, and thus renders the accurate application of the remedy very difficult.

[1] Manufactured by Messrs. S. Maw, Son, & Thompson.

Porte-Caustiques.—For applying solid nitrate of silver to the larynx, the only instrument which is thoroughly safe, and at the same time easy to use, is the Laryngeal Cauterizer, first recommended by Lewin. It consists of a piece of aluminium wire, bent at the same angle, and of the same length above and below the angle as the laryngeal brush. The wire is roughened at its extremity and then dipped into some nitrate of silver fused over the spirit lamp. In this way a certain quantity of the nitrate adheres firmly to the wire. An ingenious *porte-caustique* has been in-

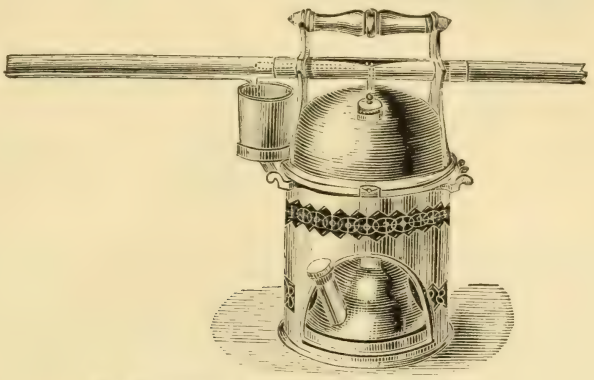

FIG. 37.—Messrs. Allen's Ventilating Croup-Kettle.

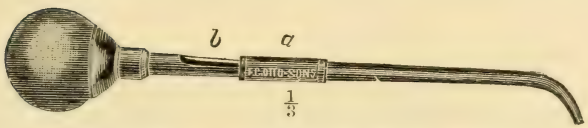

FIG. 38.—Dr. Rauchfuss's Injector: *a*, a movable tubular covering; *b*, the cavity into which the powder is put.

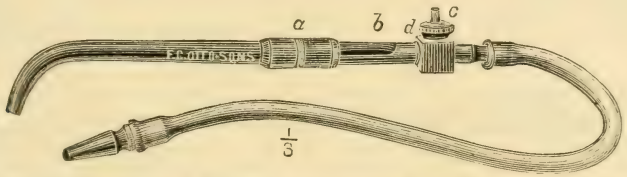

FIG. 39.—The Tube-Insufflator: *a*, a movable tubular covering; *b*, the cavity into which the powder is put; *c*, stop, which closes the passage until it is pressed down; *d*, valve which allows the air to pass toward the laryngeal extremity of the instrument, but prevents the patient expiring or coughing through the tube.

vented by Dr. Fauvel, in which, whilst the stick of nitrate of silver is safely enclosed, the point, by a spiral spring behind it, is always kept protruding. Professor Stoerk, of Vienna, also, when laryngoscopy was quite in its infancy, contrived a porte-caustique in which the caustic remains concealed till brought to the part desired to be touched, when, by pressure on a spring in the handle, it is made to protrude. My laryngeal lancet is provided with a small piece of aluminium wire, which can be fitted on in place of the cutting blade; in this way it becomes a guarded porte-caustique. The nitrate of silver is attached to the wire by fusion in the way already described.

Besides these instruments, various others have been invented, but the simple aluminium wire answers the purpose perfectly well.

Laryngeal Electrodes.—These instruments are used daily by nearly all laryngoscopists. They are so constructed that the current does not pass till the metal point or sponge is in contact with the vocal cords. The instrument is held in the hand between the thumb and second finger, and when the sponge has been placed in the desired position, the operator with his index finger presses on the key in the handle, and the electric

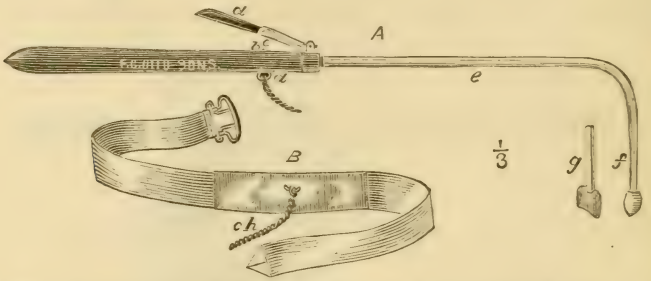

FIG. 40.—The Author's Laryngeal Electrodes and Necklet: *A*, the laryngeal electrode: *a*, a metal ring by which the electrode is connected by a chain either with a battery or a magneto-electric machine; *b*, the extremity of a wire communicating with *a*; *c*, metal point, which, when the ivory handle, *d*, is pressed upon, touches *b*. The current then passes along the wire, *e* (which is insulated in caoutchouc), to the metal ball, *f*. This completes electrode No. 1. *g* represents the spade-shaped electrode for applying the current to the posterior crico-arytenoid muscles: the handle of the instrument is of wood or glass. *B* is the necklet which the patient wears; *ch* is the chain by which the necklet is connected with the apparatus producing the electricity.

current passes through the larynx to the skin externally. At the same time the patient wears a necklet communicating with the other wire of the battery.

In Dr. Fauvel's modification of my instrument (Fig. 41, A), the two poles are united in the same handle. The two rods are carefully isolated, and only when the little key on the upper part of the instrument is touched does the current pass between the two brass knobs. In a third instrument here shown (Fig. 41, B), the electrodes are more widely separated, so that they can straddle across the ary-epiglottic fold, and embrace

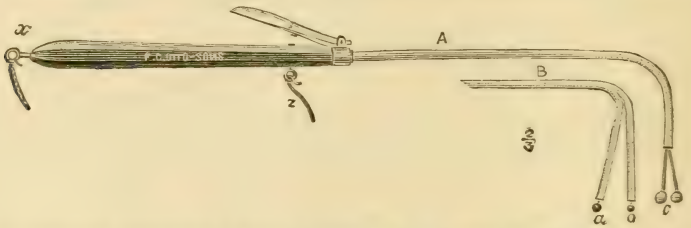

FIG. 41.—Laryngeal Electrodes Nos. 2 and 3: A represents Dr. Fauvel's modification of my instrument, which is called No. 2 electrode. The current passes between the two knobs at *c*. B represents the adductor, or No. 3 electrode. It is introduced into the larynx in such a way that the pole, *o*, is in contact with the vocal cord, and *a* passes into the hyoid fossa. In this way the lateral crico-arytenoid is embraced between the two poles. The extremity of the hyoid electrode should be about five-eighths of an inch distant from, and slightly posterior to, the pole which is applied to the vocal cord.

the lateral crico-arytenoid muscle. This arrangement is useful for limiting the electric current to the thyro-arytenoideus muscle.

Laryngeal lancets are of various kinds. My own instrument consists of a small double-edged knife or lancet, which is contained in a hollow tube, suitably curved for introduction into the larynx. The point of the lancet is concealed in the duck-billed extremity of the tube till forced

out by pressure on a spring in the handle. The stock of the instrument is provided with tubes bent at different angles, and below the angle is a joint which enables the operator to lengthen or shorten the tube. This arrangement allows for the varying inclination which the plane of the laryngeal aperture bears to the horizon, and renders the lancet fit for operating either at the upper or lower part of the larynx. The length of the blade is regulated by a screw in the handle. The instrument is held between the thumb and second finger, and when its extremity is brought opposite the part which the operator wishes to lance, he presses on the

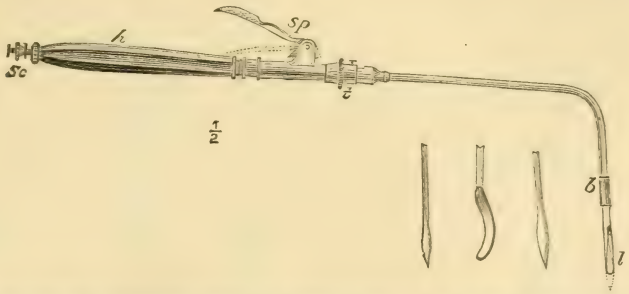

FIG. 42.—The Guarded Laryngeal Lancet and various Knives: *Sp*, the spring which forces out the lancet: when it is pressed down to the dotted line, the lancet, *l*, protrudes: *h*, the handle: *Sc*, the screws, by turning which the length of the point of the lancet can be regulated; *t*, junction of the barrel and stock of the instrument. At this point, barrels curved at different angles can be applied. *b*, the bayonet joint. A shorter or longer tube can be put on here, according to circumstances, and the blade can be taken out and cleaned. The engraving also shows the various blades recommended by Tobold.

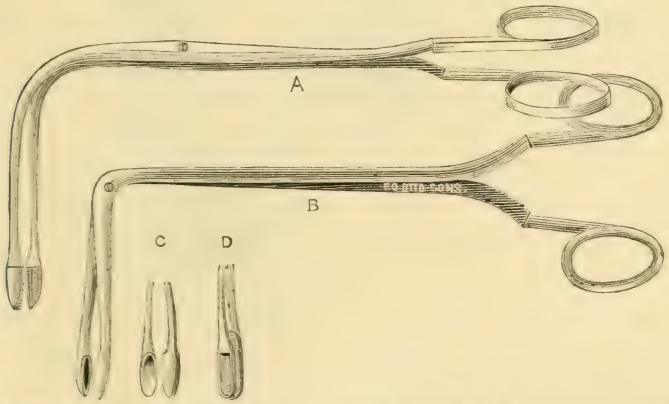

FIG. 43.—The Author's Cutting-Forceps: A, the lateral forceps; B, the antero-posterior forceps; C, spoon-shaped forceps; D, punch-forceps.

spring in the handle with his index finger. Dr. Tobold's unguarded knives give more power to the operator than can be obtained with the movable concealed blades of my protected Laryngeal Lancet, but their use should be confined to the hands of those thoroughly skilled in the use of laryngoscopic instruments.

The common laryngeal forceps are made of different lengths and curved at different angles. Some open like ordinary forceps, laterally (Fig. 43, A), whilst others open backward and forward (Fig. 43, B). The instrument is shown *in situ* in Fig. 44. I now scarcely ever use any

other instrument than these forceps for removing laryngeal growths. Larger experience has also convinced me that forceps should not be slender, but, on the other hand, rather stout. There is too much vibration and too little firmness in the slender instruments, and though they look much more suitable for delicate operations, carried out with the laryngeal mirror, they are in point of fact less serviceable. Dr. Fauvel, who has been so remarkably successful in the removal of growths from the larynx,

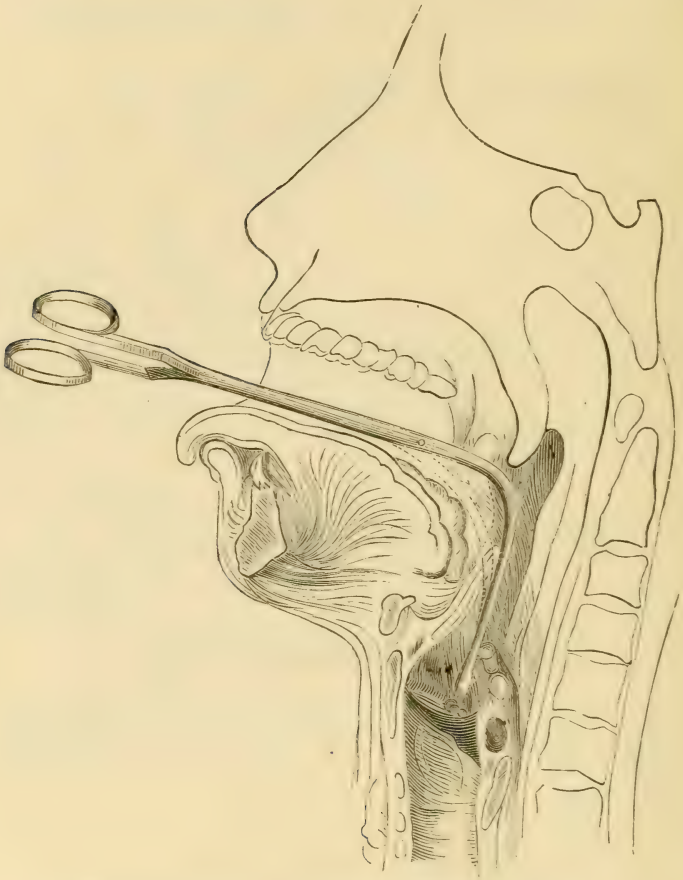

FIG. 44.—The Author's Common Lateral Forceps, shown *in situ*.

uses even stronger and larger forceps than myself. In order to grasp the growth more firmly he also has a catch fixed to the rings of the handles, so that, when desired, the blades can be made to lock.

The tube forceps consist of a steel tube of a diameter of one-tenth of an inch, containing the forceps. It is bent at an angle of 90°, but to the same stock barrels of different angles can be applied. Just below the angle is a joint which enables the practitioner to clean the forceps and apply shorter or longer blades, as the case may require. The spring which forces the tube over the forceps is at the anterior and upper part of the handle ; and the operator, holding the instrument between his

thumb and second finger, presses on the spring with his index finger. At the posterior part of the handle is a ring, by which the forceps can be made to revolve, and in this way the blades can be made to open backward and forward, or from side to side. This arrangement enables the operator to seize excrescences, whether they grow from near the anterior insertion of the vocal cords, from the arytenoid cartilages, or from either side of the larynx. The blades of the forceps have sharp-cutting teeth all round their edges. For most cases, the blades which pass down perpendicularly from within the tube containing them are convenient; but sometimes where the growths are thin and membranous, and have an extensive origin from the side of the larynx, forceps, with

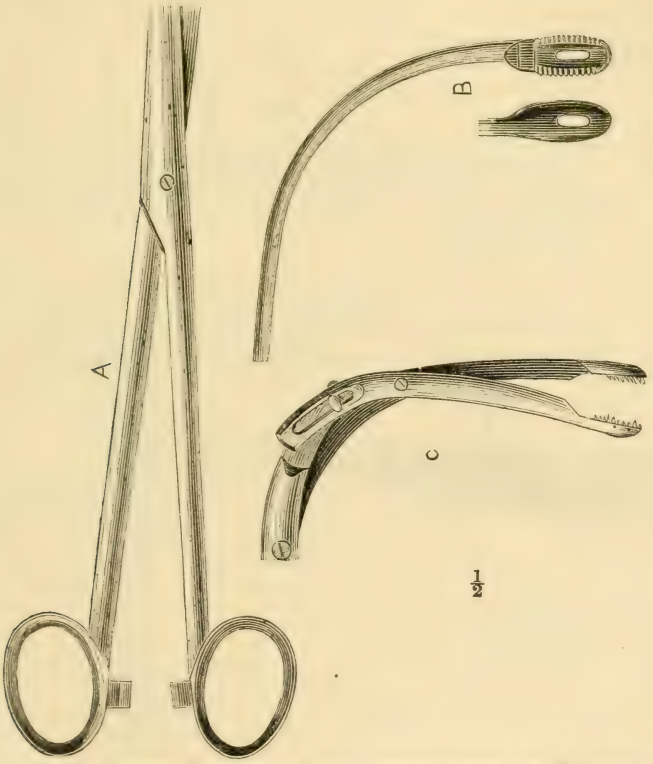

FIG. 45.—Dr. Fauvel's Forceps: A, the handle of the instrument, showing the arrangement for locking the blade; B, the lateral blades; C, the antero-posterior blades, showing the manner in which one blade plays in a slot.

blades opening horizontally, will be found more suitable. In this case the forceps have in fact only one movable blade, which is at right angles to the shank, the other blade being let into the tube: the two blades of the forceps close when the tube containing the upper blade is forced down by the pressure of the index finger on the spring in the handle.

At the joint below the angle of the instrument scissors can be fitted instead of the forceps. In order that the blades should readily cut, the shanks of the scissors should cross one another above the blades; the scissors have hooks on each blade, which seize the divided particles and prevent their falling into the trachea.

Schroetter's *laryngeal forceps* are of the tube character, but the handle is placed at an oblique angle to the shank, so that the operator's hand is kept to one side, altogether out of the field of vision. The upper blade is fixed, being in fact part of the tube, whilst the lower

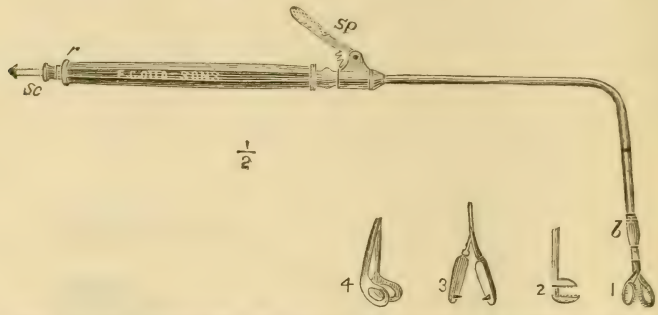

FIG. 46.—The Author's Tube-Forceps and Scissors: *Sp*, the spring, by pressing on which the tube is forced over the base of the forceps; *b*, the joint at which longer or shorter tubes may be applied, and the blades taken out and cleaned. (This joint has been made unnecessarily large by the draughtsman.) *r*, the ring, by turning which the forceps revolve so that the blades open in any direction; *Sc*, the screw for taking the instrument to pieces, cleaning it, etc.; 1, the perpendicular blades; 2 and 4, horizontal blades; 3, the scissors, with hooks attached to them.

blade is attached at right angles to a solid wire which moves within the tube. In order to reach growths in different parts of the larynx, several tubes are required for the same handle, as the forceps have only one movement (viz., the upward movement of the lower blade), which is

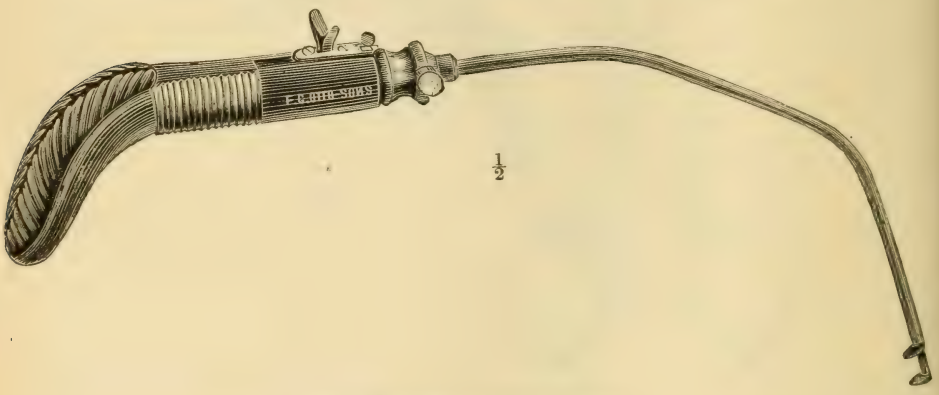

FIG. 47.—Professor Schroetter's Forceps.

brought about by touching a slide in the handle of the instrument with the thumb. These forceps are only adapted for removing very small growths, but they are particularly convenient for effecting evulsion at the anterior commissure of the vocal cords.

Écraseurs of different construction have been used for the removal of laryngeal growths with more or less success since the invention of the laryngoscope. In this country Drs. Walker, Gibb, and George Johnson have employed them; whilst in France an *écraseur*, combined with a kind of dart, which is said to transfix the growth, has been recommended by Moura-Borouillou.

To these instruments I always entertained the objection, that the wire was very likely to be displaced, and that the growth could only be accidentally ensnared after repeated trials. This inconvenience was, however, overcome by Professor Stoerk, who had an *écraseur* constructed in such a way that the wire is concealed in a solid loop of metal. This

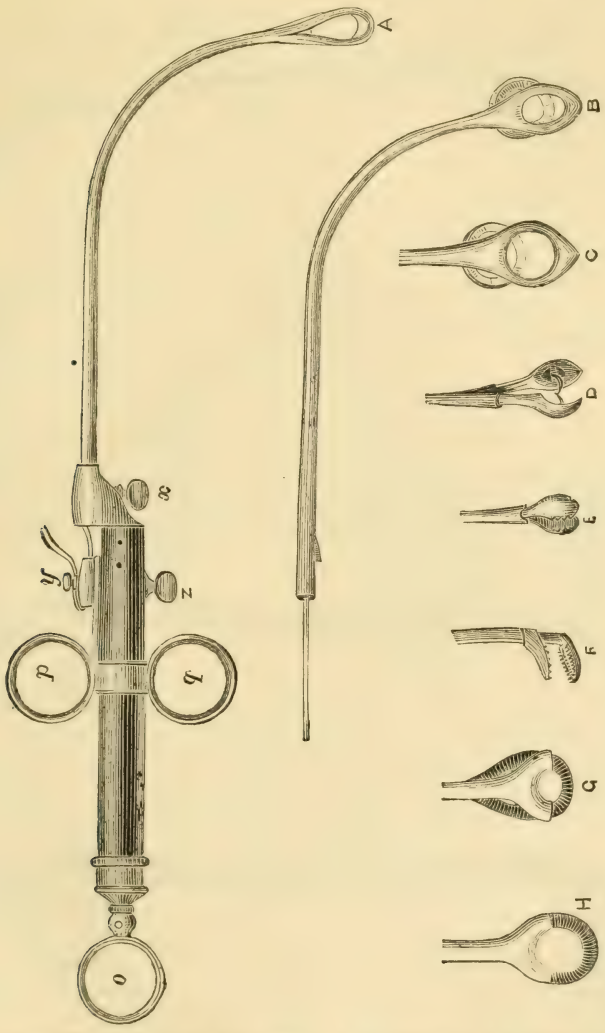

FIG. 48.—Professor Stoerk's Guillotine and Forceps: A, wire écraseur; B, guillotine: C, ditto (larger); D, E, and F, forceps; G and H, improved guillotine, avoiding the loss of space in B and C; H shows the guillotine open; G, the same instrument half closed.

prevents the wire being pushed aside when the operator proceeds to put it over the growth. The instrument is thus rendered much more serviceable, but it really acts more on the principle of a *guillotine* than an *écraseur*, and, indeed, Professor Stoerk employs the same handle with a circular knife instead of the wire. For operating on very large growths

I have, however, used a modification of Stoerk's instruments, in which, by means of a cog-wheel, that can be turned by the index finger, the wire slowly crushes through the growth on the true principle of the

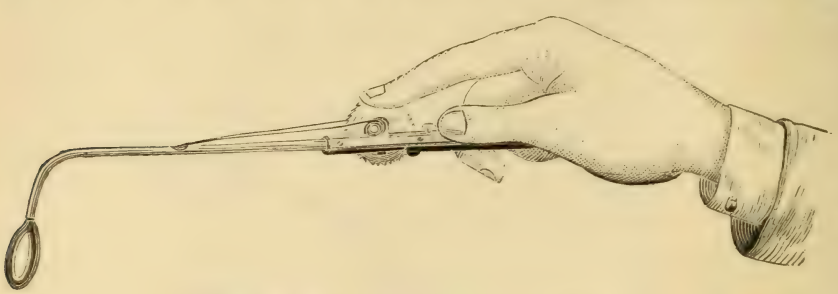

Fig. 49.—The Author's Guarded-Wheel Écraseur.

écraseur. I have called this instrument the guarded-wheel *écraseur*. Two cases in which it had been employed were brought by me before the Pathological Society[1] some years ago.

DILATORS OF THE LARYNX.

For dilating the larynx when it has become blocked up by organized membrane or by cicatricial tissue, various dilators have been invented. In most cases the use of these instruments is facilitated by the previous

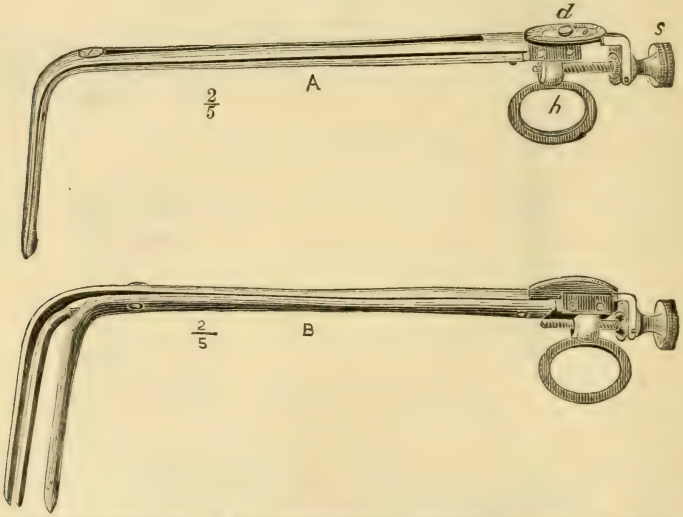

Fig. 50.—The Author's Dilator: A, the instrument closed; by turning the screw, *s*, the blades separate, whilst the dial, *d*, shows the extent to which the dilatation has taken place.

performance of tracheotomy, which is almost certain to have become necessary.

[1] Trans. Path. Soc., pp. 52 and 53 (1870).

The screw dilator is an instrument which I have occasionally used for the last fourteen years. It consists of three blades which, when united together, form a solid instrument easily introduced into the larynx. When the instrument has been passed into the constricted larynx, a screw at its proximal extremity enables the operator to open the blades and thus effect distention, the degree of which is shown on a dial placed near the screw.

Professor Navratil, of Pesth, has invented an instrument very much on the principle of my dilator, but much more perfect in its details, and consisting of four segments instead of three; moreover the dilating action in his instrument is confined to its laryngeal portion, whilst in mine it extends a little above its angle. The only objection to Professor Navratil's instrument is its extremely complicated construction, which renders it liable to get out of order and difficult to clean.

Dilating tubes were first introduced by Professor Schroetter, and the profession is greatly indebted to that physician for developing the treat-

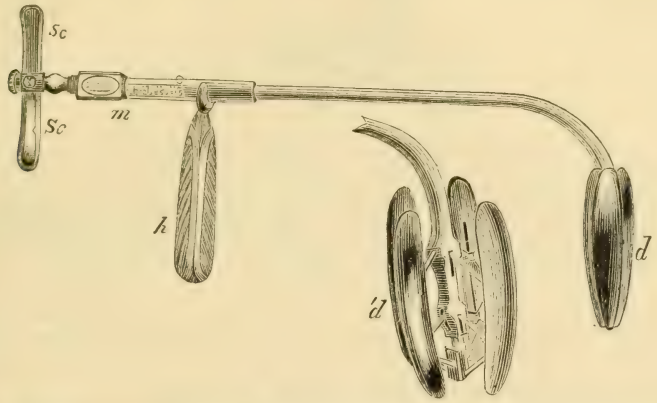

FIG. 51.—Professor Navratil's Dilator. This instrument consists of a silver tube containing a steel rod, terminating at the distal extremity in an olive-shaped body, rather pointed below and broad above, the dilator proper (*d* and *'d*), and at the proximal end in a screw (*Sc*); between the two is a handle (*h*), which the patient holds alter the introduction of the instrument into the mouth. The olive-shaped dilator varies in length from 4½ to 6 centimetres, and its diameter is from 12 millimetres to 8 millimetres above, and from 5 millimetres to 2 millimetres below. The olivary body (*d* and *'d*) consists of four segments, each segment having three joints; the segments can be made to extend symmetrically to a distance of from 20 to 30 millimetres by turning the screw, and a measure on the instrument, between the handle and its proximal extremity, indicates the amount of dilatation that has taken place.

ment of a very difficult class of cases. Professor Schroetter originally employed hollow curved tubes of vulcanite of various sizes. Small tubes are first used, and subsequently when the larynx is more dilated, larger tubes can be employed. The fact that these tubes (although hollow and thus permitting the patient to breathe) cannot be tolerated for more than a few seconds on account of the pharyngeal irritation and retching which they produce, led Professor Schroetter to invent the instrument now to be described.

The Laryngeal Dilating-Plug.—This instrument consists of a leaden plug, which is temporarily attached to a suitably curved hollow tube by means of twine passing through the tube. It can only be used when tracheotomy has been previously performed, and a canula is worn with an opening in its upper surface. The plug is introduced into the larynx, and its lower end, which is perforated by an oblique passage, passes into

the tracheal canula. It is retained in this position by a bolt, which takes the place of the ordinary inner tube of the canula. When the plug is thus fixed in position the laryngeal tube is withdrawn, whilst the twine which is left protruding from the mouth can be tied round the neck or behind one ear. When it is desired to withdraw the instrument the bolt is

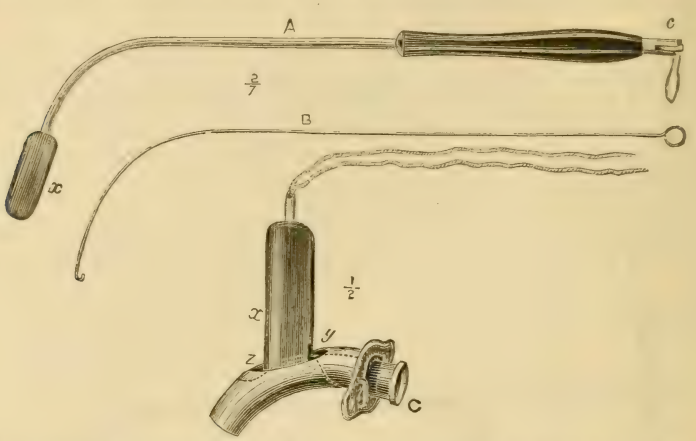

FIG. 52.—Professor Schroetter's Dilator: A, the instrument ready for use. It is a hollow, curved tube, fitting into a perforated handle, and terminating in a metal plug (*x*). The latter is kept attached to the tube by a piece of twine, which passes through the tubular instrument, and is fixed to the proximal extremity of the handle by a clip. The metal plug has a ring at its upper part and a small canal (*y*) passing obliquely through its lower extremity. B is a fine silver rod, by means of which the twine is drawn through the tube when it is being prepared for use; C corresponds to the inner tube of a tracheotomy canula, which, instead of being continued as a tube, terminates in a bar (*s*), passes through the plug when *in situ* (*i. e.*, in the contracted larynx) and bolts it in position.

removed from the canula and the plug is drawn up from the larynx by means of the twine. It may be allowed to remain in the larynx for an hour or half an hour the first time, but this period may be gradually increased until the patient retains it for the whole day.

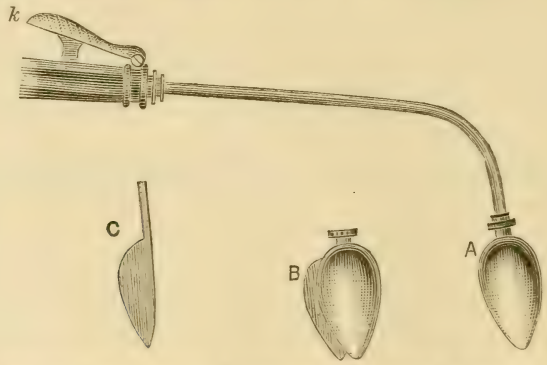

FIG. 53.—Dr. Whistler's Cutting-Dilator: A is the olivary extremity of the instrument, with the blade concealed; B shows the blade projecting from its sheath, when the key (*k*) is pressed upon; and C, the blade altogether removed from its covering.

The Cutting-Dilator.—Dr. Whistler has invented a very ingenious cutting-dilator, which is particularly serviceable for dividing webs or membranous formations.

This instrument consists of a pointed, olive-shaped body, placed at the end of a suitably curved shank, and containing within its interior a sharp blade, which can be made to protrude by touching a little key in the upper part of the handle. When the instrument is passed into the larynx, any existing web is put upon the stretch, and thus rendered tense for division. The knife is so arranged that it can be made to cut forward toward the anterior commissure or backward toward the inter-arytenoid fold, according to the situation of the stricture.

ACUTE CATARRHAL LARYNGITIS.

(Synonyms: Spurious Croup. Acute Catarrh of the Larynx. Acute Laryngitis.)

Latin Eq.—Laryngitis acuta catarrhalis.
French Eq.—Laryngite catarrhale.
German Eq.—Akuter kehlkopfkatarrh.
Italian Eq.—Catarro acuto della laringe.

(*See* also Œdematous Laryngitis.)

Definition.—Acute catarrhal inflammation of the mucous membrane of the larynx, seldom dangerous to life, giving rise to hoarseness or aphonia, and sometimes to slight dyspnœa and stridulous breathing in children, in whom, however, it almost invariably ends in resolution. In adults, it often passes into the chronic form of inflammation, and in very rare cases may result in œdema.

History.—This disease was partially described by Millar,[1] more than 100 years ago, but that observer gave an obscure picture of the affection from mixing up catarrhal laryngitis with spasm of the glottis. Hence he was led to regard the complaint as a neurosis, and to recommend antispasmodic remedies. Guersant[2] first gave a clear account of the pathology of the disease, and employed the terms "*faux croup*" and "*laryngite striduleuse.*"

Etiology.—The causes which provoke acute catarrhal inflammation of the larynx are such as favor analogous affections of mucous membranes generally, amongst which, in so-called temperate climates, "catching cold" is the most common. Cold draughts of air, whether inspired directly, or bearing on the neck and ears externally, are particularly liable to give rise to laryngeal catarrh. Exposure of the body in general to cold, and especially allowing the feet to remain wet and cold for any length of time, are also common causes of an attack. As Krieger[3] well points out, children whose vital power has been lowered by prolonged confinement to the house in bad weather often catch cold in their first walk through dusty streets on a windy day. But frequently the cause of laryngeal catarrh is of a more local nature. Thus violent func-

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[1] Observations on Asthma and Hooping Cough, London, 1769.
[2] Revue Médicale, Octobre, 1829.
[3] Aetiologische Studien, Strassburg, 1877. Cited by Rauchfuss: Loc. cit.

tional efforts (as in giving the word of command, preaching, singing, etc.), as well as straining the parts in coughing, are not uncommon causes of it. Hot alcoholic drinks, excessive tobacco smoking, dusty air, irritating vapors, foreign bodies accidentally entering the larynx, may also be enumerated as frequent excitants of the disease. Or it may be propagated from the nares and pharynx, the more severe forms of inflammation of the latter region being especially prone to spread to the neighboring region of the larynx. Extension of the disease occasionally takes place from below, the bronchial tubes being first affected; but the opposite sequence is more usual, the laryngeal inflammation passing off with the occurrence of bronchitis. Relaxing habits and indoor occupations undoubtedly predispose to the disease. At the Hospital for Diseases of the Throat, catarrh of the larynx is much more often met with among tailors, shoemakers, house-porters, and people thus engaged, than among coachmen, cab-drivers, policemen, and others who are constantly exposed to the most inclement weather. Previous attacks, especially if several times repeated, increase the susceptibility of the individual to a renewal of the affection. Males are more liable to it than females, and adults than children, but in young subjects the disease gives rise to much more marked symptoms, and hence attracts more attention. Laryngeal catarrh is also a very usual accompaniment of hay asthma, and is often met with in the exanthemata, especially in measles.

Symptoms.—The patient complains at first of slight dryness or soreness of the throat, with hoarseness, and a disposition to cough. This sensation varies from a mere feeling of tickling or roughness, to a sense of constriction about the throat, with slight odynphagia. It rarely happens that manipulation of the organ from without causes pain, but great uneasiness is sometimes experienced on attempted phonation. The voice is usually at first hoarse or defective in timbre, but afterward it may be extinguished. The cough may be altogether absent, but it is generally rather shrill, and in severe cases may be aphonic. The respiration is not affected as a rule, but, as will be presently shown, it is sometimes embarrassed in children, the narrow area of the glottis, in young subjects, easily resulting in some stenosis, and a corresponding difficulty of breathing. In the adult, on the other hand, considerable swelling may ensue, without curtailing the breathing space. The inspiration is, however, generally a little prolonged and occasionally associated with stridor, and mucous râles can usually be heard on auscultating the larynx. Slight mucous expectoration accompanies these symptoms, but if the secretion becomes thick, purulent, and abundant, it may be regarded as coming from the bronchial tubes.

In children there is sometimes marked fever, the tongue is white and furred, with red tip and edges, the pulse frequent and hard, the skin hot, and the face flushed. In these young subjects suffocative attacks, occurring during sleep, are an important feature of the disease. This symptom has given rise to considerable confusion, both in theory and practice, as well as to much warm debate in medical circles. It generally occurs in children who, without constitutional disturbance, have manifested during the daytime some degree of hoarseness and cough, but to such a slight extent as not to excite any apprehension. At night the scene is suddenly changed. The child who has been sleeping some hours wakes up in terror, its breathing is labored, inspiration prolonged and noisy, voice and cough husky, features congested, and its whole aspect one of impending suffocation. In the general alarm the little patient is

apt to be drugged and nauseated, proceedings which a knowledge of the actual state of things will show to be for the most part unwarranted. This form of the disease has been called *laryngitis stridulosa*, and it has been generally thought to be due to spasmodic action of the adductors of the vocal cords. It is probable that muscular action operates as a secondary cause, but that it depends primarily on the laryngeal secretion becoming inspissated during sleep, when the mouth is often open. Collecting in this state in the very narrow glottis of the child, and adhering to the vocal cords, the thickened mucus gives rise to a gradually increasing impediment to respiration, till the terrified little patient awakes in a storm of anguish. Between crying, coughing, and vomiting, the difficulty is got over, and the child shortly falls asleep, to repeat, it may be in a few hours a scene which to the uninitiated presents all the features of impending death.

The laryngoscopic appearances vary with the degree of severity of the attack, as well as with the stage at which the inspection is made. In mild cases, and at an early period, the whole of the mucous membrane is of a bright red color, though the hyperæmia may be confined to certain parts, such as the posterior extremities of the vocal cords, the inter-arytenoid fold, or the ventricular bands. Sometimes there is distinct injection of the vessels, but usually the congestion is general. Occasionally hemorrhage takes place either into the tissues or from the mucous surface. The latter variety has been called *laryngitis hemorrhagica*, but it is scarcely necessary to give a special name to so rare and accidental a condition. I have met with a few cases, and examples have been recorded by Navratil[1] and Fränkel.[2] In these, as well as in nearly all the other recorded cases, the congestion was *slight*, and the hemorrhage almost always resulted from some violent expiratory effort, such as coughing or vomiting. In more severe forms the mucous membrane is swollen, as well as red ; and when, as frequently happens, the ventricular bands are affected, the turgid state of these folds causes them to overlap the vocal cords, so that the latter are entirely concealed, or seen only as slender threads of a reddish tint. When the ary-epiglottic folds are attacked they generally maintain their normal shape ; and, in these cases, the epiglottis is seldom inflamed to such an extent as to block out the view of the larynx. Small patches of shallow ulceration, or erosions, which amount to little more than a desquamation of the epithelial layer of the mucous membrane, and leave no cicatrices on healing, are not unfrequently to be seen. They constitute the *érosions glandulaires* of French authors, according to whom they arise from suppuration in the follicles of the larynx. The point at which the pus escapes becomes a minute ulcer, which heals rapidly.[3]

Various modifications of the mechanism of the larynx, to which the objective phenomena already described are due, may also be observed. Thus the changes in vocalization, noticed at the very commencement of the attack, may be seen, in some cases, to depend upon a protrusion of the swollen inter-arytenoid fold between the vocal cords ; or on a similar obstacle at the anterior commissure. Both these conditions are, however, as Ziemssen[4] remarks, comparatively rare. It is more frequent when the

[1] Laryngol. Beiträge, Leipzig, p. 18.
[2] Berlin. Klin. Wochenschrift, 1874, No. 2.
[3] Krishaber: Dict. des Sciences Méd., art. Larynx, Paris, 1868.
[4] Cyclopædia of Med., vol. iv.

patient attempts to vocalize to find a defect in the parallelism of the cords, their free margins presenting a concave outline, and forming an open glottis inconsistent with perfect phonation. This condition, as Gerhardt[1] points out, is often caused by palsy or paresis of the thyro-arytenoid muscles, and indicating, as it does, an early change in the nerve supply of the intrinsic muscles, has a deep physiological import. Although the elementary character of this treatise prohibits the discussion of this suggestive topic, it may be remarked that the derangement of motor function often precedes the superficial hyperæmia, which from being a more striking feature is apt to be regarded as the earliest expression of the inflammatory state. The alteration of the voice thus early brought about points unmistakably to an interference with the innervation of the region as the initial step in some cases of inflammation. But whatever hypothesis is ultimately adopted to explain the phenomena in question, the fact that "the longitudinal, and perhaps also the transverse tension of the vocal cords is incomplete, and probably also unequal," is regarded by Ziemssen,[2] with whose opinion I entirely agree, as a probable explanation of the "huskiness, jarring, and shrillness of the voice," which characterize the early stages of the disease.

In very severe cases *œdema* may occur, and rapidly give rise to a serious stenosis. This condition will be referred to under "œdematous laryngitis;" but it may be here remarked that acute catarrh of the larynx is, in the majority of instances, a superficial and transient affection, which under suitable treatment generally ends favorably in the course of a few days. If neglected, however, it is likely to pass into chronic laryngitis, and is occasionally the starting-point in the formation of papillary growths and other neoplasms from the mucous tissue.

Pathology.—Catarrhal inflammation of the larynx consists in a hyperæmia of the vessels of the mucous membrane. It may be either active (*i. e.*, fluxionary) or passive. In effect it causes a reddening of the mucous membrane, together with an increased succulence of the epithelial layers, and a corresponding excess of secretion, consisting, for the most part, of a watery fluid containing imperfectly developed epithelial cells. The vascular turgescence increases the lateral pressure on the walls of the vessels, and causes changes in their intimate structure. At first only the plasma of the blood exudes, but soon an immigration of colorless corpuscles takes place. In inflammation of moderate severity, these migratory cells disappear with the hyperæmia, but when the inflammatory process is more persistent they become organized and converted into lymphoid tissue. These lymphoid degenerations will be again referred to under the head of "Chronic Laryngitis." Sometimes, beyond a sodden condition of the mucous membrane there are no pathological phenomena. If the patient die from other cause, on post-mortem examination the hyperæmia is frequently not discoverable, and this is often the case when the congestion during life has assumed very considerable proportions. The probable explanation of this anomaly is to be found in the rich endowment of the mucous membrane of the larynx with elastic fibres, the contraction of which *in articulo mortis* removes the engorgement of the capillaries by pressing out their contents.

Diagnosis.—A due consideration of the foregoing conditions, both objective and subjective, should leave little room for doubt as to the na-

[1] Handbuch der Kinderkrankheiten, Tübingen, 1878, 3ter Band, 2te Hfte., p. 322.
[2] Op. cit.

ture of the affection, except perhaps in the case of very young children. In catarrh the symptoms, though they may remit, do not pass off so completely as in laryngismus. In diphtheritic inflammation, *i. e.*, true croup, the symptoms are much more severe, and there is often the presence of false membrane in the pharynx. In the absence of the latter phenomenon, the absolute necessity for confirming the diagnosis by laryngoscopic inspection, where it can be accomplished, is evident. The possibility of a foreign body having entered the air-passages must not be forgotten.

Prognosis.—This is always most favorable. Mild cases of catarrh pass off in a few days almost without treatment, and those of more severe character usually quickly yield to suitable remedies.

Treatment.—In the case of adults, the patient should be kept in a uniformly warm atmosphere; should employ warm and soothing inhalations, such as the benzoin, hemlock, or hop inhalations of the Throat Hospital Pharmacopœia, and should *abstain altogether from using the voice*, and from taking food or drink of an irritating character. A compress to the neck often arrests an impending attack, or cuts short the disease at its inception. Diaphoretics may be administered when there is any fever, and a purge is often useful at the outset. If there is any disposition to cough, the patient should be kept slightly under the influence of opium. The drinking of warm milk mixed with an equal quantity of alkaline mineral water, as soda or seltzer water, is much praised by German authors. Though empirical in origin, like the proceeding sanctioned by Niemeyer of allowing the patient to eat very salt herrings, there can be no doubt that carbonate of soda and common salt exercise a solvent effect upon mucous accumulations, and it is doubtless from this cause that relief attends their administration. In those rare cases in which there is hemorrhage from the larynx, a strong astringent, such as tannic acid (℥ ij. ad ℥ j.) should be applied to the bleeding spot. In a case of this kind Dr. Smyly, of Dublin, on one occasion immediately arrested the hemorrhage by the application of Ruspini's styptic. When the disease begins to pass off, astringent solutions, such as the zinc and iron "pigments" of the Throat Hospital Pharmacopœia, are often very serviceable.

In the case of children, a moist atmosphere maintained by the generation of steam is always advantageous. By this means the drying of the secretion during sleep is averted, and the alarming attacks of dyspnœa, due to this cause, are warded off. As in the case of adults, a warm compress to the throat often acts very favorably, and a hot sponge over the sternum is a time-honored remedy in these cases. As young children can seldom use any apparatus which requires any effort in inspiration, the warm soothing inhalations already mentioned should be employed by means of the croup-tent (see page 122) and the "ventilating croup-kettle," or with the aid of some similar arrangements. Opiates are sometimes required, and their tendency "to dry up the mucus" is best obviated by administering the remedy in the form of the compound tincture of camphor, and by combining it with squills. At the same time non-depressant emetics, such as sulphate of zinc (grs. xv. to grs. xx.), or sulphate of copper (grs. v. to grs. vii.), in plenty of warm water, may occasionally be required. In catarrhal inflammation of the larynx I do not recommend the application of remedies with the brush, but Gibb,[1] acting on the suggestion of Horace Green, employed solutions of nitrate of silver (grs. xl. ad ℥ j.), and stated that, according to his experience, one or at most two

[1] Diseases of the Throat, 2d edition, p. 197.

applications of this salt usually suffice to subdue the local inflammation. This treatment has been recommended by other English practitioners, and lately also by Professor Stoerk.[1] In my own practice, however, the results following the topical application of this salt have not been satisfactory, and I have seen the whole train of symptoms greatly aggravated by its use. Stoerk [2] further recommends that catarrhal laryngitis should be treated by the internal and external use of ice. Leeching, bleeding, blisters, mercury and antimony, the sheet-anchors of our predecessors, are remedies quite out of date in the treatment of the disease, and cannot be put in the balance against our modern methods.

Prophylaxis—In the case of children who possess a specially vulnerable mucous membrane, such as may be inherited from phthisical parents, certain *precautionary measures* should be adopted to diminish the susceptibility to catarrh. The best of these, perhaps, consists of tepid sponging with salt water on rising in the morning, followed by friction to the entire body. Judicious clothing, especially the wearing of flannel next the skin, should be enforced, and the adoption of regular out-door exercise insisted on. Great care should be taken to avoid over-heated sitting-rooms or bedrooms. At suitable seasons a residence at the seaside, for the purpose of sea-bathing, will generally prove beneficial. In the case of children and old people, the mineral waters of Royat, taken in July and August, greatly diminish the catarrhal tendency in the succeeding winters ; whilst for adults, the waters of Mont Dore have a similarly favorable influence.

ŒDEMATOUS LARYNGITIS.

(Synonyms : Laryngitis Phlegmonosa. Laryngitis Submucosa Purulenta.)

Latin Eq.—Œdema acuta laryngis vel glottidis. Laryngitis phlegmonosa.
French Eq.—Laryngite œdémateuse. Œdème aigu de la glotte.
German Eq.—Phlegmonöse Kehlkopfentzündung. Oedem der Glottis. Glottisödem.
Italian Eq.—Laringitide edematosa. Edema acuto della laringe.

Definition.—Acute infiltration of the areolar tissue of the larynx by a serous, sero-purulent, or purulent fluid, characterized in severe cases by orthopnœa, stridulous breathing and dysphonia or aphonia.

History.—The descriptions of ancient authors, founded as they are entirely on the symptoms observed during life, and expressed in terms usually vague and often confused, do not point to this disease with any degree of certainty. The observations of Hippocrates,[3] Aretæus,[4] and Celsus,[5] are equally applicable to laryngeal diphtheria, whilst those of Cælius Aurelianus [6] and Ætius [7] specially point to the plastic form of inflammation. In 1765 Morgagni [8] first gave a correct account of the conditions

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[1] Klinik der Krankheiten des Kehlkopfes, Stuttgart, Enke, 1876.
[2] Ibid.
[3] Prædict., l. iii.
[4] L. l. cap. vi.
[5] L. iv. cap. iv.
[6] L. iii. cap. ii.
[7] Βιβλία Ἰατρικὰ, l. v. c. 21.
[8] De Sed. et Caus. Morb.

founded on post-mortem examination, and subsequently Boerhaave[1] and Van Swieten[2] accurately described the œdematous character of the inflammation. These latter physicians did not, however, distinguish clearly between pharyngitis and laryngitis. Gradually medical writers became quite familiar with the malady, and in 1801 Bichat[3] described it with considerable detail, although since he speaks of it as "a particular kind of serous swelling which does not occur in any other situation," it is evident that he did not understand its pathological relations. In 1815 the various phenomena of œdema of the larynx were first scientifically portrayed by Bayle,[4] and from his writings we may date the commencement of the literature of the subject. Previous to 1852 numerous papers of more or less importance had appeared in medical journals, especially in France, but it was reserved for Sestier[5] in that year to collect these and found upon them a standard treatise containing a vast amount of statistical evidence.

Etiology.—The origin of the disease has been so minutely investigated by Sestier that it is impossible to do justice to the subject without largely making use of his laborious researches, which have reference to no less than 245 cases,[6] exclusive of cases of scald-throat. It must not be forgotten, however, that certain fallacies are present in his statistics, which cannot therefore be taken as an unerring guide in considering the etiology of this disease. For the chronic and acute forms of œdema are not separated, and many cases where a deposit of a dense character was present are included as œdema. His statistics, however, must always have considerable value.

The influence of age and sex is marked. The affection is rare before eighteen years of age, but prevails from that time to fifty, its maximum being between eighteen and thirty-five. In 215 cases, Sestier found five children under five years—one a new-born infant—and twelve cases between five and fifteen years. As regards sex, the same author noted, in 187 adults, 131 men and 56 women.

Acute œdematous laryngitis may be either *primary* or *secondary*, that is to say, it may either attack healthy persons, or may affect those previously suffering from some other complaint. In 190 cases Sestier found 36 primary and 122 secondary. The affection is called *typical* where it originates in the larynx, *contiguous* where it spreads from the pharynx or other parts, and *consecutive* where it occurs as a sequel to disease of the cartilages, or other structures of the larynx.

Typical œdematous laryngitis is extremely rare. The statistics of Sestier demonstrate, and it has already been shown in the last article, that catarrhal laryngitis is usually a mild affection of the mucous membrane, in which the submucous areolar tissue is very little concerned. According to Sestier simple inflammation was the cause of œdema in rather more than 6 per cent. of all his cases. I believe that in nearly all these instances of so-called "simple inflammation" the disease is due to blood-poisoning. I have met with the affection amongst hospital physicians, medical students, and nurses, and in cases where defective drainage seemed to be its cause. I may add that in every case that has come under my notice, ample opportunity of acquiring septicæmia has been present. Sestier's

[1] Aphorismi de Cognoscendis, etc., 801, 802. [2] Comment. in Boerhaave.
[3] Anat. descript., t. ii., p. 399. [4] Dict. des Sc. Méd., t. xviii. p. 505.
[5] Traité de l'angine laryngée œdémateuse, Paris, 1852.
[6] In some of these cases the ultimate issue was not stated, and in others, the age or sex was not given. This explains how it is that the number of cases used in the text for statistical purposes in relation to these matters, varies in different instances.

statistics in relation to this form of œdema bring out prominently another fact, viz., that acute œdematous inflammation is a very rare malady amongst children. Thus out of the 245 cases only twice did the disease occur, as a primary affection, in a child. In the fifteen examples of simple œdematous inflammation occurring amongst adults, fourteen were men and only one a woman.

Contiguous œdematous laryngitis, though rare in itself, is the most common form of the disease. Propagation most frequently takes place from the pharynx, and was found in more than 20 per cent. of Sestier's cases. Out of fifty-six instances where the disease originated in simple inflammation of the pharynx, it occurred thirty-one times in persons previously healthy, and twenty-five times in patients convalescent or suffering from some other affection. In Sestier's statistics there was not a single child among the patients previously healthy, but there were two children, between the ages of four and six years, amongst those already suffering from other diseases. The greatest number of cases occurred between twenty and fifty years of age, and the affection was twice as frequent amongst men as women. The pharyngeal inflammation was in many cases moderate and even slight, but the œdema of the larynx generally supervened during the height of the faucial inflammation.[1] It is highly probable that many cases of contiguous œdema are of an erysipelatous nature, though it is often difficult to determine whether the disease is a true phlegmasia or an example of collateral œdema. As a sequel to diphtheritic inflammation of the fauces, acute œdema was only noticed by Sestier three times in his 245 cases. Contiguous œdema rarely commences in the trachea and ascends to the larynx, Sestier[2] having only been able to find two very doubtful cases. Sometimes it follows aneurisms of the aorta or vessels of the neck, and in these cases it appears to be due to chronic inflammation of the cervical tissues, not to obstructed circulation.

Consecutive œdematous laryngitis almost always results from disease of the cartilages or perichondrium, but it may follow any deep-seated or extensive ulceration.

Acute œdema not unfrequently occurs as a *secondary* phenomenon. The acute diseases in which it is most apt to occur are small-pox and typhoid fever, but it is occasionally met with in scarlet fever, and Boeckel[3] has published a case supervening on ecthyma. It may occur during the progress of chronic tubercular or syphilitic inflammation of the larynx, though *chronic* œdema is a much more frequent sequel of these conditions. It is also occasionally found in post-scarlatinal dropsy, and sometimes in Bright's disease. Dr. Fauvel[4] has, indeed, pointed out that acute œdema of the larynx may be the first symptom of renal disease. This form of secondary œdema has also been noted by Gibbs[5] and others.[6] It must, however, be very rare in Bright's disease, as some years ago at the London Hospital I examined 200 cases of this complaint without finding œdema of the larynx in a single instance. In the same way it is seldom present in general anasarca, and from the rarity of its appearance in this condition —a condition in itself so common—Sestier[7] thinks that the "intervention of phlegmasia of the pharynx and larynx or neighboring tissues is nearly always necessary." The same argument applies to Bright's disease.

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[1] Op. cit. pp. 70 and 71.
[2] Ibid. p. 99.
[3] Annales des Maladies de l'Oreille et du Larynx, vol. i. p. 387.
[4] Aphonie Albuminurique, Rouen, 1863.
[5] Op. cit.
[6] See Specimen No. 179,650 in Guy's Hosp. Mus.; also Lancet, 1863, vol. ii. p. 277, and 1864, Feb. 27.
[7] Op. cit. p. 123.

Symptoms.—The prominent symptom of œdematous laryngitis is the gradually increasing impediment to respiration. The patient at first experiences the sensation of a foreign body in the throat, and, after a short time, a difficulty of breathing, which ultimately threatens suffocation. At the same time deglutition is rendered more or less difficult according to the amount of swelling of the epiglottis, and the voice gradually becomes weakened and altered in timbre, until at last it is almost extinct. There is not, generally speaking, any cough or expectoration, properly so-called, but the patient usually makes violent efforts to clear his throat of the obstruction, and frequently succeeds in spitting up a little frothy mucus. To the observer, the symptoms of the malady, when fully established, are most striking and painful. The efforts of the sufferer to draw breath are from the first very evident; and, as the disease advances, the phenomena of orthopnœa are highly distressing. Inspiration is accompanied by a whistling sound, which is very characteristic of the narrow condition of the glottis. The dyspnœa is, to a greater or less extent, constant, but paroxysms occur from time to time, any one of which may prove fatal. In these attacks the patient sits up in bed, with his mouth open, and gasps for breath. His eyes start from his head, and his whole body often trembles with an intense convulsive movement. A general cyanosis after a time commences, the face becomes of bluish hue, and, if nature or art does not afford immediate relief, death rapidly occurs from asphyxia.

Physical examination of the part may be made by the finger or by the laryngoscope, but the latter alone gives reliable information. If the finger is passed into the throat great gentleness must be exercised, as otherwise we may produce a dangerous suffocative paroxysm.[1] The epiglottis may be felt to be very much thickened, and the ary-epiglottic folds may have attained such a state of tumefaction as to convey to the finger an impression similar to that which is given by touching the tonsils.[2] When the laryngoscope can be used the aspect of the parts is very characteristic. The color of the mucous membrane is generally bright red. The epiglottis has the appearance of a semi-transparent roll-like body or ridge, or, losing its normal contour altogether, it presents two round red swellings pressed against each other. It is often merely erect and tense. It is this condition of the epiglottis which explains the pain and difficulty accompanying the act of swallowing. In many cases the swollen epiglottis blocks the view of the interior of the larynx. Occasionally, however, the ary-epiglottic folds appear distinctly as two translucent folds, which almost meet over the entrance to the larynx, and often touch each other in the median line at each effort of inspiration. It rarely happens that the vocal cords themselves are infiltrated, but a case of this kind has been reported by Risch,[3] and I have twice met with a similar condition in tertiary syphilis.

Sometimes the œdema is limited to that part of the larynx which is below the level of the vocal cords. This form of œdema was first accurately described by Gibb,[4] under the name of "subglottic" œdema, though Sestier[5] and Cruveilhier[6] had previously made some allusions to such a condition. In these cases there is generally no swelling above the vocal cords. I have met with many examples of subglottic œdema, but they have all been of a chronic character.

[1] Trousseau: Clinique Médicale, t. iii. art. Œdème de la Glotte.
[2] Krishaber: Dict. des Sc. Méd., vol. ii. p. 618.
[3] Berliner Klin. Wochensch., 1866, No. 33.
[4] Op. cit. p. 211.
[5] Op. cit.
[6] Anat. Pathолog., t. i. l. ii. pl. ii. fig. 1.

Pathology.—On close inspection of the œdematous larynx in the dead subject, the physical appearances of the part as viewed during life with the laryngoscope are confirmed, whilst the pathology of the condition can be accurately determined. Where death has resulted from the œdema, the fluid collected in the submucous connective tissue is generally of a serous character, but it may be sero-purulent, or even healthy pus. In the latter case the pus is always diffused, circumscribed abscess never occurring as a sequel of acute inflammation of the larynx. Pure serum is found only in the most acute and rapidly fatal cases; as a rule the effusion is of a sero-purulent character. Occasionally blood is found in the tissues, especially in those cases which have run a rapid course.[1] On cutting into the diseased parts, usually but little exudation takes place, and sometimes even squeezing between the fingers does not suffice to cause the disgorgement of the œdematous structures. As the morbid process so often extends from the pharynx, the brunt of the inflammation often falls on the epiglottis, and this valve is occasionally found enormously tumefied. But as the effusion collects where the areolar tissue is most lax, the ary-epiglottic folds are the parts which are most frequently distended, and in which the swelling attains its maximum. Next in frequency the ventricular bands suffer, whilst the vocal cords may be slightly tumefied, but are rarely swollen to any extent. In very rare cases the œdema can be traced down the trachea to the commencement of the bronchi. The muscles are frequently saturated with serous fluid. If the patient survive the acute stage and die from other causes, the parts previously œdematous present a sodden and shrunken appearance. In contiguous œdematous laryngitis the neighboring structures are more or less implicated in the morbid process, and the cellular tissue of the pharynx, tonsils, soft palate, uvula, and even of the neck, is often found distended with fluid.

Diagnosis.—Previous to the invention of the laryngoscope, œdema of the larynx was liable to be confounded with several other maladies, and where some obstacle prevents the use of the instrument, the diagnosis may still occasionally be doubtful. It is, however, only necessary to enumerate such conditions—laryngismus stridulus, polypus, retropharyngeal abscess, and foreign bodies in the larynx—in order to prevent the careful practitioner from falling into error. Laryngeal diphtheria may sometimes mislead the observer, but the presence of false membrane, which can generally be seen in the pharynx or may be coughed up in shreds, determines the diagnosis. Any disease which gives rise to dyspnœa, such as aneurism of the aorta, narrowing of the trachea, cervical tumors, etc., may simulate œdema of the larynx, but the history of the case and the laryngoscopic examination will generally furnish conclusive evidence as to the real nature of the malady.

Prognosis.—Except in slight cases, or where the œdema is partial—affecting one ary-epiglottic fold or one side of the epiglottis only—the prognosis is extremely unfavorable. Even when local measures have removed the obstruction to free respiration, the patient is very likely to perish subsequently from exhaustion, or blood-poisoning, or from pneumonia or other lung complications. Dealing roughly with the literature of the subject, Sestier[2] found that the affection proved fatal in 158 out

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[1] Sestier: Loc. cit.; also Pfeufer: Henle u. Pfeufer's Zeitschrift für rat. Med., Neue Folge, Bd. iii.

[2] Op. cit. p. 241 et seq.

of 213 cases in spite of tracheotomy having been performed thirty times. In the fifty-eight cases which recovered, the trachea was opened twenty times. Bayle,[1] however, gives much less favorable figures, for he reports seventeen cases with sixteen deaths. *Secondary* œdema is more fatal than *primary*. The prognosis also depends on the kind of œdema as well as on the age and sex of the patient. *Typical* œdema is almost always fatal, whilst the *contiguous* form generally does well, if the inflammation starts from the pharynx. It is, however, invariably fatal when it spreads from the neck or chest, as in the case of aneurism of the aorta or of the large cervical vessels, and nearly always so when it commences in the external areolar tissue. In *consecutive* œdema, the local affection being almost always at the same time a secondary phenomenon, the prognosis depends on the nature of the original disease. In typhoid fever it is very unfavorable, whilst in phthisis the condition is in itself comparatively unimportant, and in syphilis it usually yields to treatment. The affection is more serious in men than in women. According to Sestier, in the former four-fifths of the cases prove fatal, and in the latter only three-fifths. The same author states that the greatest mortality (in proportion to those affected) occurs between ten and thirty years, when eight-ninths of the cases prove fatal. The next highest mortality is between fifty and seventy, whilst the maximum power of resistance appears to be between thirty and forty and forty and fifty, in which two decennia, about one-half of the cases, according to Sestier, prove fatal.

Treatment.—Prompt local treatment must be adopted in order to remove the laryngeal obstruction. Local bleeding, by means of leeches placed over the sides of the larynx, is often of considerable service, and in mild cases may effect so much reduction in the œdema as to render the subsequent progress of the case free from danger. The inhalation of pulverized liquids, especially of a solution of tannin as recommended by Trousseau,[2] may also be tried. Ice should be uninterruptedly swallowed, and the patient should be kept constantly under the influence of bromide of potassium. It will usually, however, be necessary to carry out some more decisive measures. Scarification, first practised by Lisfranc,[3] is often successful when the disease is circumscribed. This operation may be performed by means of a long, sharp-pointed bistoury, covered, except for the last quarter inch of its length, with adhesive plaster or lint. The best instrument, however, for the purpose, is the laryngeal lancet (page 186). A primitive method of scarifying the larynx was practised by Legroux,[4] who lacerated the mucous membrane with one of the finger nails specially sharpened to a point for the purpose. After scarification, gargling with warm water and steam inhalations will much facilitate the expulsion of fluid from the tissues. If scarification is unavailing we must have recourse to tracheotomy, and it is better to perform this operation early, than to wait until an almost moribund condition of the patient renders surgical interference nearly hopeless.

Traumatic Laryngitis.

Violent inflammation of the larynx, involving the submucous areolar tissue, may arise from scalds of the larynx, from corrosive poisons, or from the impaction of foreign bodies.

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[1] Op. cit. [2] Loc. cit.
[3] Journal de Méd., 1823 : Mém. sur l'Angine lar. œdémat.
[4] Journ. des Connaiss. Médico-Chir., Sept., 1839.

Scalds of the larynx are frequently met with amongst children of the laboring classes. This accident, which is seldom seen except where English customs prevail, was first described by Dr. Marshall Hall,[1] and subsequently by Stanley,[2] Burgess,[3] Wallace,[4] Ryland,[5] and Liston.[6] At a later period Jameson[7] reported several cases, and more recently Bevan,[8] Ross,[9] Jonathan Hutchinson,[10] Parker,[11] and others have recorded instances of the accident. These scalds are indeed far too common at all the general hospitals, and when I was Resident Medical Officer at the London Hospital, many cases came under my notice. Children allowed to drink tea from the spout of the tea-pot, unaware of the danger, occasionally attempt the same feat with the boiling kettle. Instant inflammation of the pharynx and orifice of the larynx sets in, and in two or three hours, or even sooner, the epiglottis becomes greatly swollen and œdematous.

The age of the patient usually renders the use of the laryngeal mirror out of the question, but the fauces should be illuminated as in laryngoscopy. Under these circumstances the erect and œdematous epiglottis can often be seen at the back of the tongue. Scarification is the most rational method of treatment. If the proper laryngeal lancet be not at hand, the œdematous parts may be incised or punctured with a gum lancet, or a curved, sharp-pointed bistoury, protected by strips of plaster to within two or three lines of its extremity. Non-depressant emetics may be given either before or after sacrification, the pressure which the act of retching exercises on the œdematous tissue favoring the effusion from the ruptured, or punctured, mucous membrane. Scarification, fairly and fully carried out, ought to supersede all other treatment, and is much to be preferred to leeches and mercurials.

Tracheotomy may be had recourse to as a last resort, though it cannot in these cases lay claim to the success which attends its timely performance in many other cases of laryngeal obstruction.

Laryngitis from corrosive poisoning is generally of a very violent character, and is frequently followed by gangrene. Tracheotomy is often called for.

Laryngitis from the presence of a foreign body can only be relieved by the extraction of the offending substance. The sudden swelling which takes place in some of these cases partakes of the character of venous obstruction, such as may be artificially produced by tying a piece of string tightly round the end of the finger. The rapidity—often only a few minutes, or even seconds—with which the tumefaction takes place, far exceeds anything that can be accounted for by inflammatory action. Should it not be possible to effect the removal of the foreign body, tracheotomy must be performed if the symptoms are at all urgent.

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[1] Trans. Med-Chir. Soc., London, 1822.
[2] Ibid.
[3] Dublin Hosp. Reports, vol. iii.
[4] Lancet, March, 1836.
[5] Op. cit.
[6] Lancet, 1839 and 1840, p. 103.
[7] Dublin Quarterly Journ., Feb., 1848.
[8] Ibid. Feb., 1860.
[9] Medical Press and Circ., 1868.
[10] Lancet, Feb., 1871.
[11] Ibid. May 1, 1875.

ABSCESS OF THE LARYNX.

(Under this head abscess of the larynx dependent on perichondritis is not considered.)

Latin Eq.—Abscessus laryngis.
French Eq.—Abcès du larynx.
German Eq.—Abscess des Kehlkopfes.
Italian Eq.—Ascesso della laringe.

Definition.—A circumscribed collection of pus due to inflammation of the soft tissues of the larynx, interfering with the vocal functions of that organ, and sometimes with the proper action of the epiglottis.

Etiology.—The causes of the disease are the same as those which give rise to diffused inflammation of the larynx. The affection is extremely rare, and generally occurs in an acute form.

Symptoms.—Dysphonia or aphonia, dysphagia, and occasionally dyspnœa are the ordinary symptoms. Which function is most involved depends on the exact seat of the affection. Tobold [1] has reported one case in which the left ary-epiglottic fold was the seat of the disease, and another in which the cushion of the epiglottis was affected. Generally the abscess develops within the larynx, or in the lower part of the pharyngeal cavity, but occasionally, as in a case reported by Rühle,[2] it points externally. If the abscess is not opened, it is extremely likely to cause suffocation, but in some cases it bursts spontaneously, and a cure results.[3] I have myself met with thirteen cases of idiopathic abscess of the larynx. In six cases, the abscess occurred at the root of the epiglottis; in four, in one of the ventricular bands; and in three instances, one of the ary-epiglottic folds was the seat of the disease. In most of my cases the symptoms were very severe: in nine the abscess was opened with a laryngeal lancet, and in four the abscess burst. All the patients recovered.

Diagnosis.—It is very difficult to diagnose this affection with certainty, for as there is generally a considerable amount of inflammation around the abscess the appearance is that of an acute inflammatory swelling. Sometimes, however, the abscess actually points, and the yellow color of the pus can be detected through the mucous membrane. As Professor Bruns [4] has pointed out, this yellow color is the only certain laryngoscopic sign of abscess, but sometimes the disease may be differentiated from œdema by the swelling being less transparent in the former case.

Prognosis.—The prognosis is generally favorable, if the abscess has not attained a very large size when it first comes under treatment. In pre-laryngoscopic times the disease has been reported to have been quickly fatal in several cases. Döring [5] recorded a case in which a soldier died on the third day from an abscess at the base of the epiglottis.

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[1] Laryngoscopie, Berlin, 1874, p. 324.
[2] Kehlkopfkrankheiten, Berlin, 1861, p. 162 et seq.
[3] Schroetter: Klinik für Laryngoskopie, Jahresbericht. Wien, 1870, p. 15.
[4] Laryngoscopie, Tübingen, 1873, p. 132.
[5] Rühle: Op. cit.

Treatment.—If the abscess is small it should be immediately opened with a laryngeal lancet, and if it has spread toward the skin, the opening should be made externally. In the case treated by Rühle, already referred to, a fluctuating tumor was felt with the finger, at the upper aperture of the larynx, and there was a swelling over the left ala of the thyroid cartilage. After using an exploratory needle an incision was made externally, and a cupful of pus was evacuated. The patient was cured in a few days. If the abscess is very large, tracheotomy should be performed, and after Dr. Semon's tampon-canula (see Tracheal Instruments) has been inserted, the abscess should be opened in the ordinary way.

CHRONIC LARYNGITIS.

(Synonym: Chronic Catarrh of the Larynx.)

Latin Eq.—Laryngitis chronica.
French Eq.—Laryngite chronique.
German Eq.—Chronischer Catarrh des Kehlkopfs.
Italian Eq.—Laryngitide cronica.

Definition.—Chronic inflammation of the lining membrane of the larynx characterized by hoarseness or loss of voice, and generally by more or less cough. Occasionally the malady causes thickening of the affected membrane, and sometimes leads to ulceration.

Etiology.—The causes of this affection are the same as those indicated under the head of acute laryngitis, to which disease it often proves the sequel. It sometimes results from too prolonged use of the voice, especially among clergymen and schoolmasters. The chronic forms of inflammation also frequently extend from the pharynx, and the effects of continuity of texture are often seen in chronic alcoholism and the abuse of tobacco. It is commonly supposed that elongation of the uvula by mechanically irritating the epiglottis and orifice of the larynx is an almost certain cause of chronic laryngitis. I have seen several cases in which an obstinate and teasing cough, together with some congestion of the larynx, were apparently produced, or at least maintained, by an elongated uvula, the affection subsiding almost immediately after a portion had been snipped off: but on the whole I am inclined to agree with Ziemssen[1] that the causal influence of this condition has been greatly overrated, and that Rühle[2] is correct in observing that the enlargement of the uvula and laryngeal malady are merely coexistent effects of the same cause—chronic pharyngitis.

The influence of an atmosphere impregnated with atomic matter, in the production of disease, has long been recognized. In the last century, Bubbé,[3] Ramazinni,[4] and others, drew attention to this cause of morbid

[1] Cyclopædia of Medicine, vol. iv.
[2] Die Kehlkopfkrankheiten, Berlin, 1861.
[3] Dissert. Inaugur., etc., Halæ, 1721; Hufeland's Journ. vol., xcviii. p. 4.
[4] Abhandlungen von den Krankheiten der Künstler und Handwerker, translated by Ackermann, 1780, vol. i. pp. 123, 147; vol. ii. p. 27.

action, and in our own time, Holland,[1] Heussinger,[2] Virchow,[3] Lewin,[4] Headlam Greenhow,[5] and other physicians have further elucidated the subject. It need, therefore, only be observed here that the larynx suffers in common with the rest of the respiratory system in the case of needle grinders, pearl-button turners, and others who work in an impure atmosphere, the chronic form of catarrh being especially common amongst persons so occupied.

The great and sudden development of the larynx which takes place at puberty in males is often attended by chronic laryngitis, the so-called "cracked voice" of boys being always associated with marked congestion of the vocal cords. There seems also to be a rare constitutional condition, where there is a tendency to chronic inflammation of many of the mucous canals. Seven such cases have come under my notice, all the patients being men over fifty years of age. I had at one time a gentleman under my care who was suffering from chronic laryngitis, slight thickening of the walls of the lower third of the œsophagus, gastro-intestinal derangement, and chronic cystitis.

The influence of age and sex is very marked in cases of chronic laryngitis, adult males being by far the most common sufferers, and children the rarest. As a secondary phenomenon chronic laryngitis is, of course, almost invariably present in all long-continued diseases of the larynx, such as phthisis, syphilis, polypi, cancer, lupus, etc.

Symptoms.—The subjective symptoms of chronic laryngitis vary considerably under different conditions. When the patient refrains from using his voice, the local sensations are not very marked, some dryness and irritation in the throat, with occasional tickling cough, being all that is complained of. If the patient, however, exercises his voice for any length of time, these symptoms become much aggravated, and he is soon obliged to seek relief in silence. In some cases, in addition to the symptoms above mentioned, a burning or pricking pain is felt, and there is often a frequent desire and effort to clear the throat.

Objectively, the phenomena of chronic laryngitis consist in a marked alteration of voice and a slightly increased secretion, and in certain definite anatomical changes. Impairment of the functions of the larynx is the most characteristic symptom of the disease. It varies in degree from slight modification in tone to complete loss of voice. It is characteristic also of this form of hoarseness *in the early stage*, that it is most marked when the organ has been at rest for some time. Thus, a patient with slight chronic congestion may be extremely hoarse on attempting to speak after an interval of silence, and yet the voice will become almost normal after the function has been exercised for a few minutes. The improvement probably depends on the quickened capillary circulation and stimulated nerve-force of the part, and has its analogy elsewhere. If, however, the patient continues to talk for a time, fatigue is experienced, and hoarseness or aphonia supervenes. In chronic laryngitis the voice is sometimes clear and natural in its ordinary tones, and the discordance is only observed

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[1] Diseases of the Lungs from Mechanical Causes, and Inquiries into Conditions of Artisans exposed to the Inhalation of Dust, by Dr. G. Calvert Holland, London, 1843.

[2] Ueber anomale Kohlen- und Pigmentbildung, Eisenach, 1823.

[3] Anatomische Beschreibung der Krankheiten der Circulations- und Respirationsorgane, Leipzig, 1841.

[4] Beiträge zur Inhalationstherapie in Krankheiten der Respirationsorgane, Berlin, 1863.

[5] Chronic Bronchitis, London, 1870.

when powerful exertions are made (as in singing, acting, public speaking, etc.). The cough is generally rather frequent, but it may amount to nothing more than "hawking," or "hemming," and sometimes it is almost entirely absent. In some cases, however, it constitutes the most troublesome symptom.

As regards *secretion*, the expectoration is never abundant, unless the laryngeal affection is complicated with bronchitis. The mucus discharged from the larynx is generally of a whitish gray color, and of viscid consistency, but in cases of long standing it is yellow, and after violent exacerbations of coughing, frequently appears streaked with blood. Respiration is seldom much affected, but moist râles can generally be heard over the larynx.

The laryngoscopic appearances are usually very marked, but vary considerably in different cases. A general or partial hyperæmia is invariably present. The redness is generally suffused and fades off gradually into the healthy-colored membrane, but injection of the minute vessels is sometimes apparent, especially on the epiglottis and vocal cords. On the former the injection is usually arborescent, on the latter the arrangement of the vessels is generally linear, along the attached side of the vocal cord. Sometimes one vocal cord is seen to be bright red, whilst the other is of the usual white color, and the congestion may even be limited to a small portion of one cord. In the latter case it is always the outer attached portion of the cord which is congested. Small pellets of mucus are often seen sticking to different parts of the laryngeal membrane; and in cases of long standing, the whole surface of the larynx is frequently covered with secretion. In some cases the mucous membrane, instead of presenting the velvety appearance which generally accompanies any pronounced congestion, looks dry and glistening. General tumefaction of the mucous membrane and submucosa is a very pronounced feature in inveterate cases, the epiglottis, ventricular glands, and inter-arytenoid fold all participating in a diffuse and uniform thickening. In the case of the vocal cords this change sometimes causes a granular condition of their surface, and often a very perceptible unevenness of their edges. *Derangements in the mobility of the larynx* may often be noticed. Some of these phenomena are of a mechanical nature, and depend on muscular action being clogged and impeded through the thickened state of the mucosa and submucosa. Thus the hypertrophied inter-arytenoid fold prevents the normal approximation of the arytenoid cartilages and vocal cords; while the swollen ventricular bands sometimes almost obliterate the ventricles of Morgagni, and, encroaching on the vocal cords, materially impede their movements. In addition, however, to these mechanical effects, true muscular pareses of peripheral origin are often present; in such cases, as Ziemssen[1] observes, the paralysis is more often unilateral than bilateral. Where only one cord, however, is paralyzed, the impaired movement is made up for by increased activity on the part of its fellow, which is dragged across the middle line, beyond its usual range of movement. By this means approximation and phonation are secured, and in such instances obliquity of the closed glottis can be seen with the laryngoscope.

Erosions, or very fine shallow ulcerations, which extend no deeper than the epithelial layer, are not unfrequently visible. Their most frequent seat is between the arytenoid cartilages and on the cartilaginous cords. Ulcerations, which pass through the whole thickness of the mu-

[1] Loc. cit. p. 216.

cous membrane, are of very rare occurrence in this affection, and perichondritis is very seldom met with, except in the subglottic regions.

In addition to congestive swelling of the mucosa and submucosa, there occurs in some rare cases an organic thickening or hypertrophy of the soft structures. The epiglottis, ventricular bands, and ary-epiglottic folds are occasionally affected in this way. Lewin[1] has specially noticed the thickening of the ary-epiglottic folds in preachers. He attributes it to the forcible depression of the epiglottis by the contraction of the muscular fasciculi contained in the ary-epiglottic ligaments—a movement necessary to produce the deep, hollow tones which express pathos. It must be observed, however, that swelling of the ary-epiglottic folds is exceedingly rare in this country except in laryngeal phthisis, and the interarytenoid fold is far more frequently thickened; nodular excrescences, the result of chronic inflammation, are often met with.

Pathology.—The disease is essentially a chronic inflammation of the lining membrane of the larynx, in which the vessels of the areolar tissue participate very little. Enlargement and tortuosity of the small vessels is found in cases of long-standing congestion, together with increase of the connective tissue, while the sub-epithelial portion of the mucosa is often converted into a lymphoid tissue. The latter by encroaching on the epithelium gives rise to the superficial erosions seen during life.

Diagnosis.—An accurate opinion can only be formed by careful laryngoscopic examination. It is of the first importance in every case of supposed chronic laryngitis to observe whether there is thickening, and if this condition exists, to determine whether it is due to inflammatory tumefaction, œdematous infiltration, or tuberculous deposit. In simple chronic laryngitis the natural contour of the parts is almost always preserved, but the coloration is somewhat redder than that of health. In œdema the swelling is generally of a bright color, and has a characteristic transparent appearance; in phthisis, on the other hand, the thickened parts are usually of a dull color, though the surface may be accidentally congested; the swelling, also, as a rule, presents certain determinate forms, which will be described in treating of that disease. In all cases of chronic laryngitis of some months' standing the lungs must be most carefully examined, the history of the patient and that of his family closely investigated, and his general condition inquired into, before a decided opinion as to the nature of the disease is given.

Prognosis.—The tendency of the disease, when once fully established, is to remain stationary, or the symptoms may disappear for a short time and then recur. Under persistent local treatment and the careful avoidance of the exciting causes of the affection, however, recovery can generally be secured. In old people the malady is always complicated with chronic bronchitis, and the symptoms of the latter affection mask and outweigh in importance the morbid phenomena dependent on the chronic laryngeal disease. Chronic laryngitis hardly ever terminates fatally, almost the only possibility of such an occurrence consisting in the supervention of perichondritis, and such an issue is excessively rare, except when the disease occurs in the subglottic region.

Treatment.—Local remedies of an astringent character are the most important agents in the treatment of chronic laryngitis. Any of the following "Pigmenta" (Throat Hosp. Phar.) may be used: Ferri perchlor. (60 gr.), ferri persulph. (60 gr.), ferri sulph. (120 gr.), cupri sulph. (10

[1] Virchow's Archiv, Bd. xxiv. p. 429.

gr.), zinci chlorid. (30 gr.), zinci acet. (5 gr.), zinci sulph. (10 gr.), aluminis (30 gr.), alum. chlor. (60 gr.), dissolved in an ounce of water or glycerine. The latter solvent, through its denser consistency, is better adapted for keeping up a prolonged action on the part. Solutions of the crystals of nitrate of silver were strongly recommended by Green [1] in follicular cases, but they do not seem to me to act more beneficially than other mineral astringents. The solution of chloride of zinc is the remedy I most frequently employ; but provided the medicament is applied accurately and sufficiently often, it really matters very little which solution is used. The application should be made daily for the first seven days, on alternate days during the second and third week, twice in the third week, and so on, at gradually increasing intervals till a cure is effected. This is a general rule, but it must be modified according to circumstances. In cases where there is excessive secretion from the larynx (laryngorrhœa), the local application of turpentine sometimes does good, but these cases are generally very troublesome to treat. On the other hand, when there is long-standing hyperæmia, with diminished secretion—where the mucous membrane looks dry and shining—the remedy which I have found most successful is carbolic acid (from half a drachm to a drachm of the pure white carbolic acid to an ounce of glycerine).

Another mode of applying astringent solutions to the larynx consists in the use of spray-producers (see page 182). For spray-inhalations the following remedies are most to be recommended, tannin being probably the best of all; the proportions given are always for one ounce of water: —Tannin 1 to 5 gr.; alum, 1 to 10 gr.; perchloride of iron, $\frac{1}{8}$ to 2 gr.; sulphate of zinc, 1 to 6 gr.; chloride of zinc, 2 to 10 gr. Whichever solution is selected, it should be employed three or four times a day for about five minutes. It must be understood, however, that this method of local treatment is generally only of service as a supplement to applications made with the brush.

In many cases great benefit is derived from steam inhalations containing some stimulating volatile principle. For this purpose the inhalations of pine oil, creasote, and juniper (Throat Hosp. Phar.) are among the best. Steam inhalations should, as a rule, be employed twice or three times daily for about ten minutes, at a temperature of 140°.

When persistent congestion has led to pareses of the laryngeal muscles, the systematic employment of internal electricity is of the greatest value. In fact, cases of this class seldom yield to any other treatment.

It is almost unnecessary to observe that the voice should be exercised as little as possible. For singers, actors, clergymen, and others, whose occupations require them to use the voice much, rest of the vocal organ is of the utmost importance. When complete silence cannot be enforced, the least possible exertion should be made in speaking—the patient should, in fact, whisper. If the uvula be much elongated it had better be amputated. As the pharynx is almost invariably more or less affected, astringent lozenges (Throat Hosp. Phar.) will be found very useful. Tannin, rhatany, and kino may often be prescribed in this form with great advantage.

The waters of Ober-Salzbrunnen, Ems, and Selters are especially recommended by Niemeyer,[2] who observes that " we must accept the empirical facts that these waters relieve and cure very many cases of chronic

[1] On Bronchitis, New York, 1846.
[2] Lehrbuch der Spec. Pathol. u. Therap., 7te Aufl. p. 13.

laryngeal catarrh;" whilst French physicians praise the sulphuretted waters of the Pyrenees, especially of Les Eaux Bonnes, as being appropriate to cases associated with granular pharynx. Several patients whom I have sent to the Pyrenean springs have derived undoubted benefit from the use of those waters, but, on the whole, I have seen more benefit result from the waters of Aix-les-Bains and Marlioz. The climate of the Pyrenees is subtropical, and generally very ennervating in its effects on English patients. I can particularly recommend the hot sulphur-waters of Savoy when the voice remains weak and the mucosa is relaxed rather than congested.

Where suitable atmospheric conditions cannot be selected the patient must wear a respirator, when the weather is at all cold or damp, and must protect the neck and body generally by warm and suitable clothing. Constitutional medicines and hygienic treatment will be necessary in some cases, and must vary according to circumstances.

Chronic Glandular Laryngitis.

This condition consists in an inflammation in which the minute racemose glands are principally affected. It is almost always associated with follicular pharyngitis,[1] of which malady it generally constitutes a downward extension. It cannot, however, be called "follicular laryngitis," as the glands of the larynx are all of the racemose variety (Kölliker). The term "clergyman's sore throat" has been applied to it, but the clergy more often suffer from congestion of the whole mucous membrane and paresis of the laryngeal muscles. Although usually resulting from a previous pharyngeal affection, it sometimes commences in the larynx, and afterward reaches the pharynx. It is often associated with indigestion, but whether there is any causal relation between the two conditions is uncertain. The symptoms are the same as those of simple chronic laryngitis, but perhaps milder—weakness of voice, fatigue after speaking, a constant inclination to clear the throat and swallow the saliva, or perform an act of deglutition, being the principal morbid phenomena. With the laryngoscope the enlarged orifices of the glands may sometimes be seen on the epiglottis and the posterior parts of the vocal cords as pale specks on the congested membrane, or as small red circles on the pale membrane. The other laryngeal appearances do not differ from those of simple laryngitis, except that the approximative action of the vocal cords is more often feeble and imperfect. There is frequently considerable constitutional debility. The treatment should, for the most part, be the same as for ordinary chronic laryngitis, but nitrate of silver (gr. xx. ad ℥ j.) is more useful in this complaint, and the sulphur-waters of Aix-les-Bains are especially valuable. Constitutional remedies of an analeptic character are also generally required.

Phlebectasis Laryngea.

Venous congestion of the larynx is an extremely rare affection, and I have only met with four examples of it. It may depend on general or local causes, viz., it may occur "in persons affected with a morbid preponderance of the venous system" (Hasse), or may be due to a local

[1] For a full description of this affection see Granular Pharyngitis, p. 23.

strain. Duchek [1] considers that the dilatation of the veins is one of the aggregate results of chronic catarrh. This is probably a mistake, seeing how rarely we meet with phlebectasis, and how common is chronic laryngitis. As a sequel to the latter affection, *capillary* engorgement of a passive character is often met with, but *not venous* preponderance. The symptoms are generally slight; some alteration in the voice, an uneasy sensation in the larynx, and, perhaps, a more or less frequent cough, being the principal morbid phenomena. The laryngoscopic appearances may be thus described: In mild cases, where the disease is very limited, extremely fine dark vessels may be seen running along the upper border of the ventricular orifice and epiglottis. In more severe cases there is less regularity in the distribution of the distended veins, which may be observed in the ventricular bands, vocal cords, and arytenoid cartilages. Cases have come under my notice in which streaks of blackened mucus adhering to the larynx have been mistaken for varicose veins—an error which needs only to be mentioned to be avoided. This condition of the larynx, independently of the inconvenience it occasions, is probably attended with some danger, as it most likely predisposes to passive œdema. Astringent solutions may do good, but the only treatment calculated to effect a permanent cure consists in destruction of the veins by electric cautery.

Trachoma of the Vocal Cords.

Very important organic lesions of the vocal cords are sometimes produced in persistent cases of chronic laryngitis. Amongst these a roughness of their surface, apparently arising from a partial dermoid metamorphosis of the mucous membrane,[2] is not uncommonly seen. This condition has been called *chorditis tuberosa*,[3] or *trachoma* of the vocal cords, and appears to consist in a hypertrophy of the connective tissue and a proliferation of its nuclei.[4] I have met with it most frequently in the case of singers. These cases are often extremely obstinate, and sometimes defy all treatment, but generally a prolonged course of local remedies of a strongly astringent (Ferri perchlor. ℥ ij. ad ℥ j.) or caustic nature (Argent. nit. ℥ j. ad ℥ j.) in the end effects a cure.

Subglottic Chronic Laryngitis.

Chronic laryngitis in the subglottic region sometimes gives rise to considerable thickening of the tissues, especially at the under surface of the vocal cords. When the disease is well established the tumefaction often presents the appearance of a second vocal cord immediately below the true cord. Occasionally there is, so to speak, an interruption in the swelling, so that the projection can be seen below the vocal cord for a certain length, then a clear space, whilst further on the subcordal swelling is again apparent. The color of the hypertrophied tissue is generally whitish gray, but it is occasionally red; the surface too, though usually

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[1] Virchow's Handbuch der speciellen Pathologie und Therapie. Abtheilung: Krankheiten des Larynx und der Trachea, p. 492.

[2] Ziemssen's Cyclopædia (Engl. edit.), vol. iv. p. 217.

[3] Türck: Klinik der Krank. d. Kehlkopfes, etc., Wien, 1866.

[4] Wedl. Ziemssen: Loc. cit.

smooth, is in rare cases more or less ulcerated. Hoarseness is the first symptom of the disease, but complete aphonia generally occurs at a comparatively early period. Dyspnœa is also perceived as soon as there is any considerable amount of thickening, and attacks of urgent suffocation sometimes occur. This symptom, as Catti [1] has pointed out, results from the vocal cords becoming at parts agglutinated together by viscid mucus. Rokitansky [2] was the first to discover and describe this condition, and Czermak [3] shortly after published the details of a case in which he diagnosed the affection in a scrofulous girl by means of the laryngoscope. Türck [4] published a case in 1866, and Scheff [5] in 1871. In the same year Schroetter [6] reported three cases, and in 1873 Gerhardt [7] described the disease under the name of *Chorditis vocalis inferior hypertrophica.* Since then Burow [8] has published six cases, in all of which tracheotomy was found necessary. Catti [9] has reported six cases, four of which were watched for a considerable time, and two only seen casually. In the former tracheotomy was found necessary in one instance. Other practitioners have also recorded cases, but the most important article on the subject is that lately written by Professor Schroetter [10] which contains a good résumé of our present knowledge of the disease.

Considerable doubt exists as to the exact nature of this affection, though in some cases the patients are of marked scrofulous constitution. The immediate local cause generally appears to be persistent inflammation of the mucous membrane, and the swelling differs little from the hypertrophy of the inter-arytenoid fold and posterior wall of the larynx so frequently met with. Sometimes, as Schroetter points out, the affection seems to originate in the cartilage or the perichondrium, those structures being most frequently affected either just below the anterior commissure of the vocal cords, or on the inner surface of the sides of the cricoid cartilage—situations where, it must be remembered, the mucous membrane is in direct contact with the perichondrium, whilst in other parts the cartilage is more or less protected by the interposition of muscles. In each of the three cases in which I have had an opportunity of making a post-mortem examination there was disease of the cricoid cartilage, and of one of the arytenoid cartilages.

Ganghofner [11] thinks that the affection is only one of the symptoms of the curious disease which has been described by Stoerk [12] as "chronic blennorrhœa of the mucous membrane of the nose, larynx, and trachea." Although thickening in the subglottic region no doubt often takes place in the form of blennorrhœa just referred to, yet, on the other hand, it is certain that it very frequently occurs quite independently of that affection. Schroetter, with reason I think, objects to the term "chorditis

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[1] Allgem. Wiener Med. Zeitung, 1878. No. 39, u. f.

[2] Jahrb. d. Path. Anat., iii. Aufl. bd. iii. § 16.

[3] Der Kehlkopfspiegel und seine Verwerthung. f. Phys. und Med., ii. Aufl., Leipzig, 1863, § 87.

[4] Klink der Krankheiten des Kehlkopfs und der Luftröhre, Wien, 1866, § 204.

[5] Wiener Med. Presse, No. 51, 1871, § 1313.

[6] Laryngol. Mittheilungen, Jahresbericht, etc., Wien, 1871; also Beitrag zur Behandlung der Larynxstenosen, Wien, 1873.

[7] Deutsch. Arch. f. Klin. Med., Bd. xi. 1873.

[8] Langenbeck's Archiv. f. Klin. Chirurgie, bd. xviii. 1875, § 228.

[9] Op. cit.

[10] Monatsschrift für Ohrenheilkunde, etc., No. 12. 1878.

[11] Ibid.

[12] Klinik der Krankheiten des Kehlkopfes, Hälfte, i., Stuttgart, 1876.

vocalis inferior hypertrophica," inasmuch as it localizes too narrowly a pathological condition which may affect any part of the larynx. Rokitansky considers the disease as an indurative metamorphosis of the mucosa and submucosa.

Subglottic chronic laryngitis is not so rare as is generally supposed, for between 1864 and 1872 nineteen cases came under the care of myself and colleagues at the Hospital for Diseases of the Throat, and I saw four cases at the London Hospital.[1] In every instance the disease was confined to the subcordal region, having been unilateral in sixteen cases, and bilateral in seven. But were I to include cases in which the interarytenoid fold was affected, together with the posterior portion of one or both of the vocal cords, I should be able to mention many more cases. In five of the twenty-three cases the swelling was partly translucent, and hence, no doubt, to some extent, œdematous, but in the remaining eighteen it appeared solid.

When once the disease is fully established there is no difficulty in distinguishing it, the only question which can arise is that which has reference to the density of the swelling. In the œdematous cases the swelling is generally round in outline, resembling a nasal polypus, and can scarcely be mistaken for the more substantial form of hypertrophy.

In all subglottic diseases the prognosis is relatively much more unfavorable than where the affection is supraglottic. We see this in the case of benign growths, in œdema, and in cicatricial contractions. The difficulty of treating disease locally in this situation is so enormously increased that the more unfavorable prognosis will be readily intelligible. The prospect of the patient may be inferred from a brief reference to my twenty-three cases. In three of them Mr. Evans performed tracheotomy (1866), whilst in the previous year I opened the trachea in two cases referred to me by Dr. Patrick Fraser. Subsequently, between 1866 and 1872 (inclusive), I performed tracheotomy in five other similar cases. Of the nine patients operated on either by Mr. Evans or myself, two were subsequently able to dispense with the canula, the subglottic obstruction having been got rid of mainly by the use of my dilator (Fig. 50, page 192). Of the remaining seven, three died after fifteen months, nineteen months, and twenty-seven months respectively. Of the thirteen cases not operated on, four, I believe, died without tracheotomy, in five the swelling disappeared under treatment, and in four instances the disease remained stationary for some months, and I ultimately lost sight of the patients. I have found it necessary to perform tracheotomy much less frequently in recent years, a circumstance which I attribute to my much earlier recognition of the disease.

Chronic laryngitis in the subglottic region should be treated with great assiduity, and, if possible, cured before any hypertrophy takes place. The plan of treatment recommended in the more common form of chronic laryngitis should be pursued, and if thickening occurs it should be met by the frequent passage of bougies or hollow vulcanite tubes, according to the plan laid down under Perichondritis. Even where there is considerable dyspnœa this treatment may be pursued, for, as already pointed out, the shortness of breath in these cases is often caused by collections of viscid mucus. The mucus is dispelled by the catheterism, and

[1] I have seen a number of cases since 1872, but unfortunately have not sufficiently detailed records to make use of them. My colleague, Dr. Whistler, informs me that he also not unfrequently meets with instances of the disease.

the patient often obtains immediate relief. Scarification is often of great service, and electric cautery has been successfully employed by Voltolini.[1] If, however, the dyspnœa becomes dangerous, tracheotomy must be performed. On recovery from the operation, dilatation of the larynx must be effected in the way hereinafter described.

CHRONIC ŒDEMA OF THE LARYNX.

Latin Eq.—Œdema laryngis chronicum.
French Eq.—Œdème cronique du larynx.
German Eq.—Chronisches Glottisödem.
Italian Eq.—Edema cronico della laringe.

Definition.—Serous or sero-purulent infiltration of the areolar tissue of the larynx, chronic in character, and generally occurring as a concomitant of some other local morbid condition, such as laryngeal phthisis, cancer, or syphilis.

Etiology.—Chronic œdema of the larynx is frequently the sequel of the acute affection, and it is also a very common phenomenon in the course of serious structural changes of the larynx, such as occur in syphilis, laryngeal phthisis, and cancer. In the case of the two latter maladies, the primary affection being of an intractable nature, the associated œdema can only be regarded as a subject of pathological interest. In syphilis, however, although there may be great destruction of tissue, the fundamental disease is sometimes of less immediate importance than the infiltration to which it has given birth. I met with the affection 165 times in 500 cases of laryngeal phthisis seen during life, but it was present in 71 per cent. of the cases examined after death. Sestier[2] found the condition due to laryngeal phthisis in 15 out of his 245 cases. In 179 of my cases of tertiary syphilis of the larynx chronic œdema was present 32 times ; it occurs in nearly every case of laryngeal cancer, as soon as the disease is well established.

Symptoms.—The *laryngoscopic appearances* of chronic œdema are somewhat similar to those described in the section on acute œdema, but the picture of the disease is modified by the phenomena of the primary malady, as well as by its slower rate of progress. The mucous membrane is generally much paler than in acute œdema. The disease comes on so slowly, that the patient gets habituated to the insufficient supply of air, and often appears to be little embarrassed even when the lumen of the larynx is greatly diminished.

Diagnosis.—A laryngoscopic examination at once reveals the condition of the larynx.

Prognosis.—This depends principally on the nature of the primary malady. Tuberculosis and cancer are necessarily fatal, but of course death may occur prematurely, through the intervention of serious œdema

[1] Monatsschrift für Ohrenheilkunde, etc., 1878, No. 9.

[2] Op. cit. p. 103. Pulmonary phthisis was present in three other cases, but in these instances the œdema spread from an inflammatory or purulent point external to the larynx.

of the larynx. On the other hand, in syphilitic cases, the secondary œdema is of more immediate importance than the radical disease, and the best result can often be obtained by appropriate treatment.

Treatment.—Scarification is often of the greatest service in cases of phthisis and syphilis, but in cancer tracheotomy best promotes the comfort of the patient, and the prolongation of his life.

NON-MALIGNANT TUMORS OF THE LARYNX.

(Synonyms: Benign Growths in the Larynx. Polypus of the Larynx.)

Latin Eq.—Polypi laryngis.
French Eq.—Polypes du larynx.
German Eq.—Larynxpolypen. Kehlkopfpolypen.
Italian Eq.—Polipi della laringe.

Definition.—New formations of benign character, forming projections on the mucous membrane of the larynx, generally giving rise to aphonia or dysphonia, often to dyspnœa, and occasionally to dysphagia.

History.—Isolated cases of laryngeal polypus are to be found at a comparatively early date, the case in which Koderik successfully operated on a growth through the mouth, about the year 1750,[1] being one of the first described. Seventeen years later, Lieutaud [2] published 2 cases of undoubted laryngeal polypus. In 1833 Brauers,[3] of Louvain, attempted to remove a growth by thyrotomy. In 1836 Regnoli [4] recorded a case in which he extirpated a laryngeal growth through the mouth, after performing tracheotomy, and in the following year, Ryland [5] devoted several pages of his classical work to tumors of the larynx. It was not, however, until the year 1850 that a complete monograph appeared. Then it was that Ehrmann published his celebrated treatise [6] which included 31 cases of laryngeal growth. In the year 1851 [7] Rokitansky brought forward 10 additional cases; and in 1852 Dr. Horace Green,[8] of New York, published 39 cases, 2 of which had occurred in his own practice. In the following year Dr. Gurdon Buck [9] collected 49 cases, including his own interesting example; and in 1854 Middledorpf [10] brought together 64 cases. Finally, in the year 1859, Prat published a case in which he had removed a growth

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[1] George Herbiniaux: Parallèle des différens Instruments, avec les Méthodes de s'en servir pour pratiquer la Ligature des Polypes dans la Matrice, en forme de Lettre à M. Roux, avec Figures. A la Haye, chez Gosse et Percl., 1771. This case is quoted by Lewin: Deutsche Klinik, March 29, 1862.

[2] Historia Anatom. Med., lib. iv. observ. 63, 64, 1767.

[3] Cited by Ehrmann. (See Note 6.)

[4] Osservazione Chirurg., etc., Pisa, 1836.

[5] A Treatise on the Diseases and Injuries of the Larynx and Trachea.

[6] Histoire des Polypes du Larynx, Strasbourg, 1850.

[7] Zeitschrift der k. k. Gesellschaft der Aerzte zu Wien, März, 1851.

[8] Polypi of the Larynx and Œdema of the Glottis, New York, 1852.

[9] Transactions of the American Medical Association, 1853.

[10] Die Galvanokaustik, Breslau, 1854.

through the thyro-hyoid membrane.[1] Amongst all these cases there are only 9 in which an attempt was made to remove the growth during life, and one of these, viz., that by Koderik, already referred to, is so vague, that it must necessarily be excluded.

On the invention of the laryngoscope, laryngeal growths were investigated with great zeal, and cases were soon published by Czermak,[2] Lewin,[3] Gibb,[4] Fauvel, [5] Walker,[6] and others. In 1865 Professor von Bruns [7] issued a monograph containing 17 cases, and in the following year Dr. Louis Elsberg [8] published a prize essay containing 13 cases. In 1868 von Bruns [9] reported 23 additional cases. In the year 1871 I published a work [10] containing 100 consecutive cases operated on by myself (from 1862 to 1870), and 189 other cases—being all the cases reported up to that time in medical literature. Here I may, perhaps, be allowed to observe parenthetically, that I have since operated on 123 other patients (from May 25, 1870, to December 31, 1878). The conclusions, as regards the etiology and nature of the growths drawn from my second series, being almost identical with those derived from the first set, I have not thought it necessary in this article to alter the various percentages formerly arrived at. I may mention, however, that owing to the more careful exclusion of malignant disease, the results, as regards the restoration of voice and absence of recurrence, have been more favorable in my recent cases. In 1872, Stoerk [11] published 36 cases operated on (1871 and 1872), and in 1874 Tobold [12] reported 206 cases, with 70 operations (between 1861 and 1874). In the same year Schnitzler [13] recorded 35 cases operated on (from 1872 to 1874). In 1875 Oertel [14] recorded 68 cases, 59 of which were operated on (between 1862 and 1874). In 1875 Schroetter [15] related 84 cases, 48 of which were operated on (from 1870 to 1873). In 1876 Hopmann [16] recorded 25 cases, with 18 operations (from 1870 to 1875). In the same year Fauvel [17] published 300 cases, with 220 operations (from 1862 to 1875). Between 1874 and 1876, Boecker [18] published 40 operations. In 1878 Paul Bruns [19] published a work on the relative merits of endo-laryngeal treatment and thyrotomy. This treatise is based on an examination of all the cases already referred to in this article, and includes besides 200 cases operated on by von Bruns (1868 to 1878), 35 cases ope-

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[1] Gazette des Hôpitaux, 1859, No. 103, p. 809.
[2] Wien. Med. Wochenschrift, January 8, 1859.
[3] Deutsche Klinik, 1862.
[4] Diseases of the Throat. Second edition.
[5] Du Laryngoscope au point de vue pratique, 1861.
[6] Lancet, November, 1861.
[7] Die Laryngoskopie, etc., Tübingen, 1865.
[8] Morbid Growths within the Larynx, Philadelphia, 1866.
[9] Polypen des Kehlkopfs, Tübingen, 1868.
[10] Growths in the Larynx, London, 1871.
[11] Laryngoscop. Operationen, Wien, 1871–72.
[12] Laryngoscopie, Berlin, 1874.
[13] Med. Presse, Wien, 1874.
[14] Deutsches Archiv für Klin. Med., 1875.
[15] Laryngol. Mittheilungen: Jahresbericht der Klinik für Laryngoscopie, Wien, 1875.
[16] Deutsches Archiv für Klin. Medizin, 1876.
[17] Traité pratique des maladies du Larynx, Paris, 1876.
[18] Deutsche Klinik, Nos. 33–41, 1874; and Deutsche Med. Wochenschrift, No. 34, 1876.
[19] Die Laryngotomie zur Entfernung intra-laryngealer Neubildungen, Berlin, 1878. Whilst making use of the original work, I have also availed myself of an excellent *précis*, by Dr. Felix Semon (Medical Examiner, May 23 and 30, 1878).

rated on by Paul Bruns (1871 to 1878), and 75 other cases operated on by various laryngoscopists, amongst whom may be mentioned A. Burow, Labus, Navratil, Waldenburg, Voltolini, Beschorner, Schech, Sommerbrodt, Michel, Sidlo, Heinze, Halbertsma, Jelenffy, Scheff, Krishaber, Elsberg, Ruppaner, Hartman, and others. Since the issue of Paul Bruns' work, further cases have been published by Lefferts,[1] Clinton Wagner,[2] and others.

Etiology.—Chronic congestion of the laryngeal mucous membrane is, far above all other causes, the most important etiological feature, in the production of simple morbid growths in the larynx. In some cases the disease appears to originate in an acute or subacute form of inflammation, but it is generally only as the starting-point of chronic hyperæmia, that the more acute attack indirectly leads to the production of a new formation. The most common cause of hyperæmia is probably catarrh, and catarrh must therefore be looked upon as the great predisponent of growths. Neither syphilis, nor phthisis, nor any other constitutional condition, appears to favor the development of true growths, but both these dyscrasiæ—especially the tubercular—give rise to false excrescences or inflammatory outgrowths. In cases of phthisis these formations, when present, occur at the posterior part of the larynx—generally on the interarytenoid fold. When a very protracted syphilitic congestion occurs, growths may arise; but this is a rare exception, and Dr. Harlan has well pointed out that few true laryngeal growths can be attributed to syphilis.[3] The fact, to be shortly referred to, that the affection is occasionally present at birth, makes it probable that a congenital predisposition to the disease may sometimes exist, though the neoplasm is not actually formed till adult or middle life.

Some of the exanthemata, especially variola, scarlatina, measles, and erysipelas, lead to the production of laryngeal polypi, by giving rise to chronic inflammation of the lining membrane of the larynx.

The professional use of the voice is one of the circumstances most favorable to the development of growths, 21 per cent. of my patients old enough to have an occupation having been subject to this influence.[4]

Dr. Tobold[5] remarks that the affection is most common in middle life, from the thirtieth to the sixtieth year, and that laryngeal polypi are least frequently seen in childhood. Dr. Causit,[6] on the other hand, considers that they most frequently occur in early infancy. The latter author, indeed, believes that the disease is very often congenital. But this mode of origin, though very probable in many cases,[7] has only been actually established in four, viz., one recorded by Dufours,[8] two cases in my own practice,[9] and one, the most important of all, reported by Dr. Arthur Edis.[10] In this case the child died from suffocation *thirty-seven hours after birth*, and a cyst about the size of a hazel nut was found in the la-

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[1] Medical Record, February 9, 1878.
[2] Ohio Med. and Surg. Journ., 1878.
[3] American Journal of Medical Science, vol. lii. p. 122.
[4] Growths in the Larynx, p. 16.
[5] Die chronischen Kehlkopfskrankheiten, Berlin, 1866, p. 200.
[6] Études sur les Polypes du Larynx, Paris, 1867.
[7] Paul Bruns considers that there are at least twenty-three cases on record in which the affection was congenital. (Op. cit. p. 177.)
[8] Archives Générales de Méd., Mars, 1867.
[9] Trans. Path. Soc., vol. xxv. p. 35.
[10] Trans. Obstet. Soc., vol. xviii. p. 2.

rynx. According to my experience, the middle period of life would appear most favorable to the development of these neoplasms, and I find that after the age of fifty there is a considerable and sudden diminution in their number. In 100 cases treated in my own practice, the decennium of forty to fifty furnished the greatest number of cases, whilst there were as many as seventy-two between the ages of twenty and fifty. On the other hand, there were only three patients over sixty. I have lately removed a papilloma from a woman aged seventy, in whose case the symptoms of the affection had only existed a few months; but the greatest age at which a growth has been seen occurred in the practice of Dr. Bruns, who met with a case in which the patient was seventy-four years old.

As to the causal influence of sex, of my 100 patients, 62 were males and 38 females. Of 187 patients in the practice of other operators, 135 were males, and 52 females.

Symptoms.—It will be readily understood, that, as a rule, the signs and symptoms of a growth in the larynx depend on the nature, on the exact situation, and on the size of the neoplasm. Thus a growth on the vocal cords causes aphonia or hoarseness; a growth on the epiglottis produces dysphagia; and a large tumor, wherever situated, is likely to give rise to dyspnœa.

The functional signs furnish very imperfect evidence, except to those who have had large experience of such cases. From the varying and peculiar character of the voice, the croupy cough, and the paroxysmal dyspnœa, the presence of a growth may be occasionally inferred by the experienced laryngologist; but those who have not met with many laryngeal polypi would be rash to form a diagnosis from such symptoms. It must not be forgotten, however, that many years before the laryngoscope was invented, both Brauers and Ehrmann [1] were able to diagnose growths with such accuracy, that they felt justified in opening the thyroid cartilage.

An alteration in the voice, though not invariably present, is the most constant symptom of a growth in the larynx. In my 100 tabulated cases, the voice was impaired ninety-two times; there being complete loss of voice in fifty-five cases, and hoarseness in thirty-seven. Impairment of voice was the only symptom in no less than 52 per cent. of my cases. As has been remarked by Czermak, a small growth often interferes with vocalization more than a large one; for the small neoplasm, being almost always sessile, greatly modifies the vibration of the vocal cord to which it is attached, whilst a large one often becomes pedunculated as it grows, and by rising up into the cavity of the larynx, interferes very little with the normal formation of sound. Growths on the epiglottis and ary-epiglottic folds do not generally affect the voice, unless they attain a very large size; and the same is not unfrequently true of small neoplasms on the ventricular bands. Growths below the vocal cords, on the other hand, by diminishing the column of air passing through the larynx, or by being forced up into the glottis in expiration, often cause aphonia.

Patients with laryngeal growths do not, as a rule, suffer much from cough; but this symptom is occasionally so severe as to cause very great inconvenience, and it may even give rise to hæmoptysis. The character of the cough depends upon the size and situation of the growth; it is generally dry and hacking, and often aphonic. In young children, and in adults when the growth is very large and situated in the neighborhood

[1] Op. cit.: Cases xv. xxix.

of the glottis, it has often a croupy character. In seven out of the twenty-six cases noticed by Dr. Causit it was described as "croupal." I have seen it occur also in two cases in violent paroxysms.

Dyspnœa was present thirty times in my 100 cases, and was serious in fifteen cases. Difficulty of breathing occurred in about the same percentage of the cases reported by other practitioners.[1] Most of the specimens of laryngeal growths in the metropolitan museums were taken from patients who died from suffocation; and in nearly all the cases reported in the medical journals before the invention of the laryngoscope, dyspnœa was a prominent symptom. The difficulty of breathing is often paroxysmal. The explanation of this circumstance, as in many other cases of laryngeal obstruction, is, that the patient is able to breathe well, even through a narrowed windpipe, provided that no further diminution suddenly occurs. If, however, the patient takes cold, and the mucous membrane becomes a little swollen, a paroxysm of dyspnœa may supervene. In the same manner, if the respiration be hurried by exertion, an attack is likely to come on. Sometimes, also, dyspnœa occurs suddenly, from the patient getting into an unusual position, and from the growth being consequently thrown more across the glottis. In one of my cases[2] the patient could only sleep with the hand resting under the neck; and if by chance her head slipped away during sleep, she immediately woke with a severe attack of dyspnœa. It almost invariably happens, that inspiration is much more difficult than expiration, and Lewin[3] has remarked, that the character of the respiration has a certain diagnostic value, as regards the seat of the growth. When inspiration is noisy and stridulous, and expiration comparatively easy, the growth is probably situated above the vocal cords, and *vice versâ*.

According to my own experience, actual pain is seldom caused by growths in or about the larynx, but uneasy sensations are occasionally felt. In only one of my 100 cases[4] was there decided pain, though in another[5] there was a sensation of oppression. Though patients rarely complain of a feeling of a foreign body in the larynx, they frequently have a disposition to clear the throat, as if to expel some accumulated mucus. I have most commonly met with this symptom in cases of pedunculated growths, especially when they were attached to the vocal cords.

Difficulty of swallowing does not generally occur, except when the growth springs from the epiglottis or where it attains a very large size; it is occasionally present, however, when the neoplasm arises from the arytenoid cartilages. In my 100 cases dysphagia was only present eight times, and in every instance[6] the epiglottis was the seat of the disease. In one case only[7] was there odynphagia.

The physical signs are much more important than those of a functional character, and amongst them those observed with the laryngeal mirror stand pre-eminent. So complete is the information furnished by the laryngoscope, that were it not that there are certain rare and exceptional cases in which this instrument cannot be employed, the general semeiology would be useless. The situation of the growth can almost always be ascertained with the mirror, but in a few cases, where the growth is very large, the *exact seat of origin* may be concealed. The vocal cords are especially liable to be affected, these parts having been alone attacked in seventy-four of my cases, and suffering either alone or in conjunction

[1] Mackenzie: Op. cit. Appendix D. [2] Ibid.: Appendix A, Case 84.
[3] Deutsche Klinik, 1862. [4] Mackenzie: Op. cit. Appendix A, Case 97.
[5] Ibid.: Case 90. [6] Ibid.: Case 83. [7] Ibid.: Case 28.

with other parts in no less than eighty-five cases. On the other hand, the arytenoid cartilages, with their folds of mucous membrane and secondary cartilages, enjoy comparative immunity.

The laryngoscopic appearance can best be described in detail, by separating the different kinds of tumors, according to their pathological nature.

Papillomata (Figs. 54–56) are generally sessile, though occasionally pedunculated. They are often multiple, and sometimes occur symmetri-

FIG. 54.—Papilloma in a Child æt. eight.

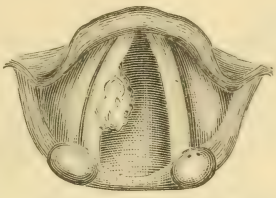

FIG. 55.—Solitary Papilloma in an Adult.

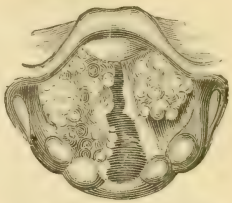

FIG. 56.—Multiple Papilloma in an Adult.

cally.[1] They vary in size from a grain of mustard to a walnut, but they do not often attain the latter dimension. Their most common size is that of a large split pea. They are generally of a pink color, but they may be white, or even bright red.

Fibromata (Fig 57) are usually round or oval, but occasionally are of a very divided form, not unlike cauliflower excrescences.[2] They are generally, but not invariably, pedunculated. Their surface is usually smooth, but it may be rough, irregular, or wavy, and they are commonly of rather a bright red color. They are almost always single, and vary in size from a split pea to an acorn.

Myxomata (Fig. 58) are very rare. In the single case[3] which I have met with, the neoplasm grew from the right vocal cord, and was only in

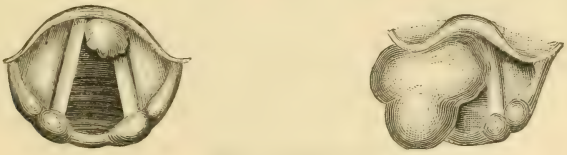

FIG. 57.—Fibromata.

part of a mucous character; this portion was seen with the laryngoscope to be quite transparent, and of a bright pink color.

Cystic Tumors (Fig. 59) most frequently occur on the epiglottis, or spring from the ventricle of Morgagni. They are round, egg-like projections, and, as they usually rise to some local irritation, are themselves red, and are surrounded by a hyperæmic area.

Angiomata (Fig. 60).—The two growths of this kind which have come under my notice, were of a blackberry-like appearance, in color, form, and size; one grew in the right hyoid fossa, the other from the right ven-

[1] Mackenzie: Op. cit.: Appendix A, Cases 40 and 80.
[2] Ibid.: Cases 78 and 97.
[3] Ibid.: Case 99.

tricular band. A similar growth has been observed in the former situation by Fauvel.[1]

Lipomata.—In the only case of lipoma on record[2] the growth was bi-lobate, of yellowish white color, and had a membranous pedicle, which appeared to project from the whole length of the ventricle.

By means of the laryngeal sound the density, the size, and the exact origin of a growth may often be determined, when with the laryngeal

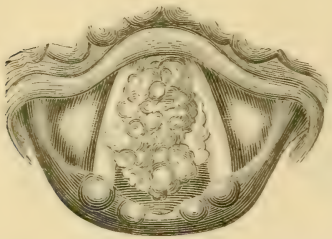

FIG. 58.—Myxoma.

FIG. 59.—Cyst.

mirror alone there is still doubt as to these various points. A smooth growth may be either a fibroma or a lipoma; but whilst the former does not yield to pressure, the fatty growth is soft and resilient. The appearance of a laryngeal growth in the mirror is frequently deceptive, and it is often only by moving it with the sound, that its dimensions can be at all accurately determined. This is more especially the case, from the fact that only one surface of the tumor is visible in the mirror. Again, the insertion of a growth is sometimes hidden by the growth itself, and it is only by traction with the crochet that the precise origin can be ascertained. The various kinds of sounds and crochets which are useful are shown in Fig. 26, p. 179.

FIG. 60.—Angiomata.

Examination with the index-finger is of some value in those cases in which the growth is situated on the epiglottis, or the ary-epiglottic folds; but it may give fallacious results,[3] and is seldom of any practical service where the tumor is attached at a lower level.

By pressing the larynx upward with one hand on the thyroid cartilage, and by drawing forward the tongue with the other, the upper laryngeal orifice may occasionally be seen, and growths in this situation are thus sometimes visible. Voltolini[4] recommends that in addition to external manipulation and holding out the tongue, the fauces should be slightly irritated, so as to produce moderate retching.

On auscultation of the larynx, when the growths are at all large, moist sibilant râles may be sometimes heard, but they are only characteristic of laryngeal obstruction. When the larynx is blocked up with growths, a dull sound is elicited on percussion. Small growths, however, do not in any way modify the usual resonance. It occasionally happens, especially in papillomatous growths, that small particles are expectorated, and, on microscopical examination, their nature can be verified. When this oc-

[1] Op. cit. p. 882.
[2] Bruns: Kehlkopfpolypen, p. 84.
[3] Growths in the Larynx, p. 204.
[4] Berlin. Klin. Wochenschr., 1868, No. 23.

curs in conjunction with other symptoms, it of course furnishes general evidence as to the nature of the disease; and when there is aphonia at the same time, it may be inferred that the growth is in the neighborhood of the vocal cords.

In the early stages, the disease is purely local; but if the growth become large, it may, by embarrassing the respiration, or through other causes, give rise to constitutional disturbance; in this way, some amount of wasting and hectic may be caused, and these cases were formerly mistaken for phthisis. Marked constitutional symptoms are, however, of exceedingly rare occurrence. The various symptoms already described generally develop themselves slowly, taking many months for their evolution. There is always a difficulty, however, in fixing upon the commencement of the disease, because the hyperæmia, which generally precedes the growth of a tumor, gives rise to the same phenomena as the neoplasm itself. The progress of the case depends, of course, in a great measure, on the pathological nature of the neoplasm. After attaining a moderate degree of intensity, the symptoms often remain stationary, and it is surprising how long some patients—especially among the industrial classes—will suffer from aphonia before they seek relief. In one of my cases the patient had suffered from aphonia for twenty-four years, and another from disphonia for twenty-three years. On the other hand, if dyspnœa or dysphagia be present, the patient is soon obliged to apply for medical aid.

As a curious fact recorded in medical literature, rather than as having any practical bearing on the course of laryngeal growths, it may be remarked, that there are a few instances[1] in which the disease has been cured by the accidental separation and expectoration of the entire neoplasm.

Diagnosis.—The diseased conditions which might be mistaken for growths, are those occurring in syphilis, laryngeal phthisis, elephantiasis, lupus, malignant tumors, and outgrowths. Eversion of the ventricle might also give rise to an error in diagnosis.

The *condylomata* of syphilis are seen as irregular, whitish, very slightly raised prominences on the congested membrane, the posterior wall of the larynx being their most common site. These formations are comparatively rare, and when present, generally occur from six weeks to three months after the primary inoculation; they soon disappear under the use of mineral astringents. False excrescences are the result of syphilitic ulceration and subsequent cicatrization, and occur as irregular projections in different parts of the larynx. The *gummata*, which are occasionally found in the larynx, are so evidently deposits *in* the tissues, that they are not likely to be mistaken for true laryngeal growths.

The thickening of *laryngeal phthisis* has not the defined character of a true laryngeal growth, and is generally soon followed by ulceration.

In the few cases of *lepra* that have come under my notice, in which the larynx was affected, the mucous membrane covering the epiglottis was uniformly swollen. I believe that the disease never attacks the mucous membrane until after it has shown itself on the tegumentary surface. The thickening of *lupus* is generally very much like that which occurs in tertiary syphilis, and is usually soon followed by destructive ulceration.

It is not always easy to distinguish between *benign* and *malignant* laryngeal growths; the latter, however, may be generally recognized by being more thoroughly blended with the surrounding tissues, and by being very frequently ulcerated. In these cases, should particles be expec-

[1] Paul Bruns and Oertel: Op. cit.

torated, or removed during life with the aid of the laryngoscope, the microscope may afford useful information.

Outgrowths, whether of cartilaginous, fibrous, or lymphoid character, are not likely to lead to mistaken diagnosis. It is true that the symptoms are often similar to those caused by laryngeal growths, but when the laryngoscope is used, the entire absence of demarcation between the protuberance and the normal tissues, in the case of outgrowths, is at once evident. When seen with the laryngeal mirror, they appear rather as non-inflammatory swellings or infiltrations than as defined tumors. A very characteristic case of this sort, in which the outgrowth was probably of fibrous character, is contained in my Jacksonian Prize Essay.[1]

Eversion of the ventricle is, perhaps, the only intelligible source of error, and this condition is extremely rare. I only know three such cases in the literature of medicine. Two[2] of these were only recognized on post-mortem examination, but in a third Dr. Lefferts,[3] of New York, at once diagnosed the disease with the mirror.

Pathology.—Papillomata are by far the most frequent of all the benign growths in the larynx. In my 100 tabulated cases, sixty-seven were judged to be of this character. These growths occur at an earlier period of life than the other kinds of tumors, nearly all cases found in the first decennial period being papillomatous.

Oertel[4] and Paul Bruns[5] distinguish three varieties, which show marked differences with regard to the interval occurring between the operation and the recurrence. The first class, consisting of light red or dark red tumors, varying in size from a millet-seed to a bean, with uneven surface and broad base, sometimes solitary, but generally thinly scattered, and never numerous, either does not recur at all, or only after some months. The second form, consisting of whitish gray exquisitely papillary, warty, or conical tumors, nearly always originating with a broad base from the vocal cords in adult patients, also recurs very slowly, often not till after several years. The third form consists of large reddish tumors resembling a mulberry or cauliflower. They may be solitary but are most frequently multiple, and are commonly seen in children. These growths generally recur after one or two months, and in three or four instances have been known to undergo epitheliomatous degeneration. In estimating the circumstances which govern the recurrence of papillomata, these differences, as well as the question, whether the papilloma has been *radically* extirpated, are to be considered. In several reported cases repeated recurrences took place at the primary seat of the growth, which was evidently incompletely eradicated, but ultimately a complete cure was effected by the thorough removal of the new-grown papilloma. There is also a class of cases, in which papillomata appear, after removal of the primary tumor, on other, previously healthy, parts of the larynx. These are not exactly recurrences, nor due to the operation, but simply show that even complete removal does not afford any guarantee of permanent cure, if there be a tendency to the formation of papillomatous growths.

Fibromata are of two kinds: (*a*) the firm and (*b*) the soft, and the former are twice as common as the latter. (*a*) Firm fibromata, though not nearly so common as papillomata, are next in order of frequency to

[1] MS. and Colored Drawing in the Library of the Royal College of Surgeons.
[2] Mackenzie: Op. cit. p. 34.
[3] New York Medical Record, June 3, 1876.
[4] Deutsches Archiv für klin. Medizin, Bd. xv. p. 290.
[5] Op. cit.

those neoplasms. They were found to exist in 11 per cent. of my cases. The youngest patient affected was twenty-seven years of age, the oldest fifty-seven. In this class of neoplasm, the rate of growth is much slower than in the case of papillomata. Though generally situated in the submucous tissue, fibromata are supposed to grow in some cases from the perichondrium;[1] when examined microscopically, they are seen to consist of bundles of white fibres, diverging and interlacing in various directions, and generally covered with several epithelial layers. These growths show no disposition to recur. (*b*) Soft fibromata consist of more or less perfectly developed fibro-cellular tissue, and have diffused through their substance a greater or less quantity of serous-like fluid. They are comparatively rare in the larynx, being found in only 5 per cent. of my cases. The ages of the patients were 18, 21, 28, 30, and 65. In the few cases that have been seen, the rate of growth appears to have been rather slow. When removed, they have no disposition to recur. In each of my cases, also, there was only one growth. Trachomata (page 214), which are generally considered in connection with chronic laryngitis, are closely allied to fibromata.

Myxomata, or true mucous growths, are exceedingly rare in the larynx, and I have not myself met with a single instance in which a laryngeal neoplasm was entirely of a myxomatous nature.

Lipomata, or fatty tumors, are rarely found in the larynx, only one case, which occurred in the practice of Professor Bruns,[2] having hitherto been published. The epithelium was of a laminated character, consisting of about fifteen layers. The membranous envelope contained two oval fatty tumors, one about the size of a filbert, the other about half that size. The neoplasm also contained a small cartilaginous growth about the size of a hemp-seed, surrounded on all sides by connective tissue.

Cystic Tumors are comparatively rare. Of my 100 tabulated cases, only two were of the true cystic character. Cases have also been reported by Virchow,[3] Bruns,[4] Durham,[5] Gerhardt,[6] Schroetter,[7] and Edis.[8] These growths generally spring from the epiglottis or from one of the ventricles. They generally have dense walls, and are more or less completely filled with thick, white, semi-fluid, sebaceous-like material, though sometimes the product is a thin yellowish or brown colloid fluid. Although, from our knowledge of other retention cysts, we might have anticipated that cystic tumors of the larynx would be likely to fill again, experience, so far as it goes, seems to show that when they have been thoroughly laid open, their contents emptied, and the cyst wall cauterized, there is no tendency to recurrence.

Angiomata, or vascular tumors, are exceedingly rare in the larynx, and there is no evidence as to the tendency to recurrence.

Compound Growths are not unfrequent; indeed, it is often exceedingly difficult to determine to which class of neoplasms a given growth belongs.

Other kinds of Growth.—Adenomata, or glandular tumors, are seldom met with in the larynx, though acinous gland-structure is often found

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[1] Handbuch der spec. pathol. Anatomie, von Dr. August Foerster. Leipzig, 1854.
[2] Op. cit.
[3] Die krankhaften Geschwülste, vol. i. p. 246.
[4] Laryngoskopie, etc., Case xii.
[5] Trans. Med.-Chir. Soc., vol. xlvii. 1864.
[6] Ziemssen's Cyclopædia, vol. vii. p. 889.
[7] Op. cit.
[8] Loc. cit.

in papillary growths;[1] occasionally, however, the entire neoplasm consists of an hypertrophied racemose gland. It may perhaps be as well to remark here that hydatids are stated to have been found in the larynx.[2] Ryland[3] states, that "a case of this sort, developed in one of the ventricles of the larynx, has been known to project so far into the cavity of this organ, as to give rise to all the symptoms which usually attend a foreign body there." On this subject, Foerster observes,[4] that "*mucous polypi* were described as hydatids, by the older authors." Ryland also refers to cases of cartilaginous tumors of the larynx; but the examination of these growths was made at a period (1835) when histology was quite in its infancy, and the account, therefore, is not of much value. Rokitansky does not mention the occurrence of cartilaginous tumors in the larynx, but Virchow,[5] limiting the term of Enchondroma to heterologous growths, and describing those cartilaginous tumors, which arise in connection with pre-existing cartilage, as Ecchondroses, especially calls attention to the occurrence of the latter in the larynx, and remarks that "whether arising from the thyroid or cricoid cartilage, they generally grew toward the cavity of the larynx." This is not, however, invariably the case, for in a specimen which I exhibited at the Pathological Society,[6] a growth about the size of a bantam's egg, originating from the cricoid cartilage, extended downward and forward in front of the trachea. "The cartilaginous outgrowths," says Virchow, "are sometimes broad and flat, sometimes circumscribed and nodular. On examining the larynx (with the laryngoscope), an outgrowth of this sort, as it has an epithelial covering, is easily mistaken for a polypus, and at the present time, when laryngeal growths are studied with so much interest, these cases deserve special notice, as, from their thickness and hardness, any operation, carried out *per vias naturales* is altogether impossible." Professor von Bruns[7] operated on two cases of laryngeal growth, in which the neoplasm was proved to consist of thyroid-gland tissue, the disease being probably allied to the so-called struma accessoria of Albers.[8]

Degeneration of Growths.—Laryngeal neoplasms, with the exception of some very rare forms of papillomata, which may become cancerous, exhibit little tendency to retrogressive changes. Occasionally, but most infrequently, the papillary growths undergo fatty degeneration, and probably in those few cases in which spontaneous expulsion of the neoplasm has taken place, this change had previously occurred. Caustics may perhaps, in some cases, promote these degenerative evolutions. Sometimes the neoplasms undergo amyloid degenerations, and the cases of amyloid growth reported by Dr. Ernst Burow,[9] and Ziegler,[10] probably originated in this way.

Prognosis.—The tendency to death being by suffocation, and the most common symptoms caused by a growth in the larynx being dysphonia, the

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[1] The reverse of this is stated by Drs. Cornil and Ranvier in their useful little Manuel d'Histologie pathologique, p. 289; but Dr. Andrew Clark has repeatedly found portions of racemose glands in the growths I have removed.

[2] Andral: Anat. Pathol., Translation, vol. ii. p. 459.

[3] Ryland: Diseases of the Larynx, p. 226.

[4] Foerster: Op. cit. p. 210.

[5] Op. cit. p. 438 et seq.

[6] Transactions of the Pathological Society, vol. xxi. p. 58.

[7] Paul Bruns: Op. cit. p. 201.

[8] Virchow's Krankhaften Geschwülste, Twenty-second Lecture, p. 13.

[9] Laryngoscop. Atlas, Stuttgart, 1877.

[10] Virchow's Archiv, vol. xlv. p. 1.

prognosis has to be considered in relation to these two circumstances. In the few cases in which dysphagia is present, the neoplasm is generally attached to the epiglottis, and can therefore be easily removed. Under these circumstances a favorable prognosis may be given.

(*a*) *In relation to Life.*—Growths in the larynx which cannot be removed with the aid of the laryngoscope are always attended with danger to life, which is either immediate or remote, according as the neoplasm is large or small. The gravity of the prognosis is also affected by the age of the patient, the disease being, *cæteris paribus*, less dangerous in the case of adults than young children.

In *adults* death is not likely to take place from suffocation, unless the patient refuses to submit to proper treatment. Of course, if tracheotomy is performed, the peril of suffocation is at once avoided; but it must not be forgotten that, even in opening the windpipe, there is a very slight, though still an appreciable, risk. The disposition to bronchitis, which is often the immediate result of tracheotomy, when prolonged dyspnœa has prevailed, must also be taken into consideration.

In *children*, as the larynx is much smaller, the disposition to spasm is much greater, and not only treatment, but even accurate diagnosis, is much more difficult. The presence of a growth also predisposes to laryngeal affections, such as catarrhal laryngitis, and possibly laryngismus, whilst in the presence of epidemic diphtheria, the child with a laryngeal neoplasm is more likely to be attacked, and less likely to recover. In children also the prospect in relation to tracheotomy, both as regards the operation itself and its immediate results, is less favorable than in the case of adults. The prognosis, therefore, as regards a fatal termination, is more serious.

(*b*) *In relation to Voice.*—As regards the voice, a favorable opinion may, as a rule, be given if laryngoscopic treatment can be employed. If the fauces be not abnormally sensitive, if the upper opening of the larynx be of average size, if the growth be single, and if it be pedunculated, there is every probability that the voice will be restored. If the opposite conditions prevail, the prognosis is less favorable. When the growths are sessile, very numerous, and apparently closely incorporated with the subjacent tissues, the prospect of restoring the voice is extremely doubtful.

In giving an opinion as to the ultimate result of these cases, even when treatment is adopted with success, the disposition to recurrence must not be forgotten. In the section on Pathology, it may be seen that whilst some forms of papillomata show a continual disposition to reproduction, other laryngeal growths, with the exception of fasciculated sarcomata, seldom occur.

Treatment.—Before considering the subject of treatment, it may be well to observe that there are a few cases in which operative procedure is not required. Thus small growths on the epiglottis, or ventricular bands, which cause little or no inconvenience, may well be left alone. This remark especially applies to fibromata, which grow much less quickly and are more frequently arrested in their development than other growths. In these cases, all that is necessary is to make a periodical examination of the larynx, once or twice a year, to see that the neoplasm does not increase in size. Several cases have come under my observation, during the last twenty years, in which small warts, after attaining a certain size, have not undergone any further development. Further, it sometimes happens, that the neoplasm is not sufficiently defined to admit of its removal, and in some cases, where, in consequence of the advanced age or occupation of

the patient, the voice is of little importance, no treatment need be adopted unless the respiration be also affected.

But before discussing the various kinds of treatment, it will be well to inquire whether any possible evil can result from endo-laryngeal operations. The principal points for consideration are the following: 1. Does the operation ever cause such an amount of inflammation as to necessitate tracheotomy? 2. Does perichondritis or necrosis of the cartilages ever result from these operations? 3. Does a benign growth ever become malignant under the influence of laryngoscopic operations?

1. Since I have taught laryngoscopy, many young practitioners have learnt to remove growths under my supervision, and though of course these early operations are often unsuccessful, I am not aware of a single instance in which any violent inflammation has been thus set up, or any serious injury done to the larynx. Cases, however, occasionally occur in which bad results may *appear* to follow laryngoscopic treatment. Thus a patient may present himself with a large growth nearly blocking up the glottis, but with little dyspnœa. Now it must be remembered, that such a patient is in imminent danger of death; a slight catarrh, a crumb of bread going the wrong way, or a paroxysm of coughing may choke him in a few seconds. The question thus arises in these cases whether we should perform tracheotomy at once, and subsequently remove the growths by endo-laryngeal treatment, or whether we should try the endo-laryngeal method in the first instance. It must be clearly understood that, if the endo-laryngeal operation is not successful, it is certain to precipitate tracheotomy, and that a patient who, though on the brink of suffocation, might have postponed the operation for several weeks—possibly for months—may require to have his windpipe opened in a few hours or even sooner. Under such circumstances the patient and his friends—possibly even the medical attendant if he has not carefully studied the peculiar contingencies of the case—may suppose that the rashness of the operator has necessitated an extra-laryngeal operation which would not otherwise have been called for. On the other hand, if the operator had at once proclaimed the necessity of tracheotomy, he would have been free from blame in the minds of those looking on. Nevertheless the duty of the laryngoscopist, under the circumstances referred to, is clearly to try the endo-laryngeal method in the first instance, after fully explaining the situation to the patient. I can recall many instances, in my own practice, in which tracheotomy has thus been altogether avoided, cases, indeed, in which I scarcely suppose it possible to operate without being obliged to open the windpipe precipitately. In three instances, however, of large growths, in which endo-laryngeal methods were attempted, I found it necessary to perform tracheotomy a few hours—in one instance two hours—later.

2. As regards the development of perichondritis, I am not aware of any instance in which this condition has resulted from an endo-laryngeal operation. In one of my cases,[1] in which the *left vocal cord was immobile before the growth was touched*, on the removal of the growth *from the anterior commissure* of the vocal cords, the abductive action of the left cord was seen to be defective, and four months later tracheotomy became necessary. After wearing the tube for eighteen months the patient died. On post-mortem examination the *posterior plate of the posterior wall of the cricoid cartilage* was found to be diseased, and there was a fistulous

[1] Op. cit., Case 73.

communication at the base of the cartilage between the food and air-passages. The history of this case points to the probable origin of the disease in the cricoid cartilage at a date antecedent to any laryngoscopic treatment; and I would call attention to the fact that the part operated on—the anterior commissure of the larynx—was *within* the larynx, whilst the necrosed cartilage may almost be said to have been *without* that organ, and nearly an inch from the seat of the growth.

3. As regards the question of the conversion of benign into malignant growths, I may mention that in my first series of growths there was one case[1] which at first was believed to be papillomatous, but subsequently proved to be an epithelioma. In this case, the full details of which will be found in my work, the patient's throat was so irritable that only three laryngoscopic *séances* were attempted, and I only once succeeded in passing forceps into the larynx. As the whole growth was subsequently removed by thyrotomy, I cannot imagine that the single endo-laryngeal operation could have converted a benign into a malignant growth. The whole subject has recently been so ably discussed by another physician[2] that I cannot do better than make use of his observations. Whilst allowing that benign growths sometimes assume a malignant character in the entire absence of surgical interference, the writer calls attention in this respect to Virchow's[3] opinions, who admits that persistent irritation of *healthy* tissues may lead to the formation of heteroplastic growths. The author justly maintains, moreover, that the degeneration of benign into malignant neoplasms never takes place except when there is an inclination to constitutional vice ; and he points out that under these circumstances the change may take place, with or without surgical interference. He further remarks that even frequently repeated local irritation does not produce degeneration. This has been most noticeable in those cases in which, in consequence of repeated recurrences, laryngoscopic treatment has had to be recommenced *de novo* many times, sometimes even on four, five, or six occasions, until finally a complete cure was obtained.

In some cases of growth, especially in recurrent papillomata, I have operated from time to time for many years without ever observing any malignant degeneration. Indeed, in the many hundred cases of papillomata that have been operated on, I only know of three instances (Gibb, Mackenzie, and Rumbold), in which growths originally benign afterward assumed a malignant character. I am not aware that there is the slightest evidence that in any one case treatment exercised an unfavorable influence.

Were, however, the conclusions on the above points of quite an opposite character, the symptoms are often so inconvenient and sometimes so dangerous, that in by far the greater number of cases that come under notice, it would still be necessary to adopt measures for the removal of the growth, or for the relief of the symptoms it causes. These measures may be either palliative or radical.

Palliative treatment consists in placing the patient in such a condition as to relieve him of immediate danger to life. This plan of treatment is

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[1] Op. cit., Case 87, p. 183.

[2] London Medical Record, November 15, 1878, p. 495. (The article in question is anonymous, but I believe that the author is Dr. Felix Semon.)

[3] Die krankhaften Geschwülste, Bd. i. p. 349.

called for in all cases where the growth greatly interferes with respiration, where for any reason laryngoscopic treatment cannot be carried out, and where the patient is unwilling to permit an extra-laryngeal operation. The only safe palliative treatment consists, of course, in the operation of tracheotomy, and it must be recollected that this operation affords absolute protection only as regards death from suffocation. When growths situated in the cavity of the larynx attain a very large size, they are apt, after a time, to interfere with deglutition. In such cases, therefore, though tracheotomy may have removed the original source of danger, at a later stage progressive dysphagia may occur.

Radical treatment may be conducted either *internally*, through the natural upper orifice of the larynx, that is, with the aid of the laryngoscope ; or *externally*, or by direct incision into the larynx ; or by the *combined method*, tracheotomy being first performed, to place the patient in a condition of safety, and the growth being subsequently removed through the mouth.

The Removal of Growths by Endo-laryngeal Treatment.—This method represents, perhaps, the greatest triumph which the laryngoscope has effected. No danger is incurred, little or no pain is felt, and scarcely a drop of blood is lost, whilst the long-lost function of a most delicate organ may be almost instantly restored, and a morbid condition, threatening the immediate extinction of life, may be at once and for ever removed.

The removal of growths from the larynx requires ingenuity on the part of the operator in overcoming difficulties by means of mechanical contrivances, but above all, perhaps, the intelligent co-operation of the patient. Although greater *éclat* is often derived from the removal of a large growth than a small one, it will be readily understood, that, *cæteris paribus*, the smaller the growth the greater the difficulty of its removal. As a rule, a growth of moderate dimensions—that is, one between the size of a horse-bean and a Barcelona nut—is most easily seized. Of course, the difficulty partly depends on situation, the posterior portion of the glottis being more accessible than the anterior, and the upper part of the larynx than the lower. The difficulty is immensely increased when the growth is situated below the vocal cords.

Several different kinds of Instruments, and indeed different modes of treatment, are often required in the same case. It is obvious that certain kinds of instruments are better adapted for certain kinds of growths : thus the short sessile growths—the most common in the larynx—can be most easily removed with forceps ; cystic tumors only require incision, and small fibromata may frequently be treated by division of their base. On the other hand, pedunculated growths are favorable to the use of wire-loops, écraseurs, and guillotines.

Endo-laryngeal treatment may be either mechanical or chemical, and though in practice it is sometimes necessary to combine these methods, it will be found most convenient to consider them separately.

Mechanical treatment may be accomplished (1) by *evulsion ;* (2) by *crushing ;* and (3) by *cutting*. I have not thought it necessary to subdivide the last-named process into excision, abscission, and incision, as it would lead to useless repetition.

Before commencing treatment, some previous preparation is required in many cases. Congestion of the fauces, elongation of the uvula, enlarged tonsils, and hyperæmia of the larynx, must, if possible, be first subdued by appropriate remedies. Unless the congestion of the larynx

be very considerable, it need not be taken into account, but if there be active inflammation, any operative procedure would be likely to aggravate the mischief, and render tracheotomy necessary. It is also quite useless to attempt any delicate operation on the larynx while the uvula is greatly elongated or the tonsils much enlarged.

In order to facilitate endo-laryngeal operations, various procedures have been recommended for producing anæsthesia of the pharynx and larynx. It is unnecessary, however, to describe the various means recommended, such as the application of chloroform, morphia, etc., to the internal parts, the administration of opiates, bromide of potassium, etc., as I have never found any of them of the least use, and some are even dangerous in their effects.

Patients cannot, as a rule, be operated on *under chloroform*, unless tracheotomy has been previously performed, or unless the growth is within reach of the finger, or external to the larynx, viz., in the hyoid fossa or on the posterior surface of the cricoid cartilage. By inhaling a few whiffs of chloroform, however, before treatment is commenced, the larynx is sometimes rendered less sensitive. By sucking ice, also, for a few minutes before the operation, laryngoscopic treatment is more easily borne.

When the epiglottis is long, and hangs obliquely, it sometimes hinders operations on the larynx, and several instruments have been invented for raising it. Some Continental practitioners even go so far as to pass a thread through the valve, and cause it to be held back by an assistant during the operation. Though such instruments may be useful for purposes of diagnosis, I have not found them applicable where operations have been necessary.

Before introducing instruments into the larynx, they should always be warmed. This precaution should never be omitted, as it greatly diminishes the irritation naturally caused by the use of instruments in the larynx.

As no practitioner would attempt to remove growths without being thoroughly skilled in the use of the laryngoscope and in the application of remedies to the larynx, it is unnecessary to enter into minute details as to the precise mode of carrying out the operation. I may, however, observe that as, when an assistant holds out the patient's tongue, his hand and arm are apt to get in the way, and the tongue is likely to be drawn to one side, the patient should hold out his tongue himself. In the same way, if it can be avoided, I do not employ an assistant to steady the head ; for this purpose, all that is required is a chair with a high perpendicular back and narrow seat.

(1.) *Evulsion* is effected with forceps, and is applicable to all growths, except those of cystic character. Cysts have indeed been torn away ; but this is only possible where the walls are thin and membranous. This method is particularly suitable in cases of sessile growths, for here other modes of treatment are difficult, and the softer the growth, the more favorable it is for removal by evulsion. I am in the habit of removing growths with two kinds of forceps, viz., the common laryngeal forceps and the tube-forceps.

(2.) *Crushing* can be carried out with either of the two kinds of forceps already described, and was used, in conjunction with other methods, in 3 of my 100 cases ; it has also been employed by Lindwurm, Schroetter, Türck, and others. I formerly employed this plan of treatment in cases in which the growth was of dense structure, and very

firmly attached; but latterly I have generally used cutting instruments in these cases. Crushing, however, is preferable to using force in evulsion. As a rule, the stronger kind of forceps are required; but the blades should be flatter, *i. e.*, less spoon-shaped, and rougher, than for evulsion. The American translator of Dr. Tobold's work describes the process as "crushing up," and observes, that energetic and repeated compression of the tissue is all that is required to destroy the conditions of nutrition and produce mortification, and that subsequently the dead portion can be separated. It is probable that, in many cases, where evulsion is adopted, crushing takes place at the same time; in other words, that, when a growth is torn away, its base is, to a greater or less extent, lacerated and crushed. The success of evulsion must, therefore, in part, be attributed to the incidental crushing which takes place.

(3.) *Cutting* may be carried on, as already remarked, either by excision, abscission, or incision. For excision, cutting forceps are used; abscission may be performed by means of knives, scissors, guillotines, or écraseurs; while for incision, or scarification, knives or lancets are employed.

I now remove almost all growths with my cutting forceps and rarely make use of knives, scissors, or other instruments. Only very small guillotines can be used, and only a very small portion of a growth can, as a rule, be sliced off. I have never been able to employ these instruments with advantage.

Voltolini[1] has pointed out that soft pedunculated growths may be torn away by frequent up-and-down movements of a sponge passed into the larynx. Some years ago I removed a growth from the larynx of a child (on whom I was unable to use the mirror to guide the hand) with a miniature *ramoneur* (see Œsophageal Instruments). In such cases I think my croup-brush (p. 180) might prove useful.

Chemical Treatment.—Chemical treatment may be carried out either with caustics, escharotics, or galvanic cautery.

Caustics.—Solutions of nitrate of silver are generally of but little use; if employed, however, they should be exceedingly concentrated, and should be accurately applied, with a very fine camel's hair pencil, to the seat of disease. On reference to my own cases,[2] but especially to those treated by other practitioners,[3] it will be seen that when laryngoscopy was first introduced, growths were generally treated by the application of caustics. This was no doubt due to the circumstance that practitioners were not then yet aware to how great an extent operations could be conducted within the larynx, and at that time, of course, no great manual dexterity in this department had been acquired. The small utility of this treatment is, however, demonstrated by the fact that since 1862 mechanical methods have almost entirely superseded the local application of caustics. Nevertheless, there are some cases in which caustics can be usefully employed. Thus in treating cystic growths, it is a good plan to apply caustic to the interior, after an incision has been made, and the contents of the cyst evacuated.

Again, for the prevention of recurrence after the removal of papillary growths, Fauvel[4] recommends the insufflation of a powder consisting of equal parts of savine and alum.

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[1] Monatsschrift für Ohrenheilkunde, etc. No. 2, 1877. See also Nos. 3 and 8, 1878, and No. 1, 1879.

[2] Op. cit., Appendices A and C. [3] Ibid., Appendix D. [4] Op. cit. p. 256.

Escharotics.—On a few occasions I have employed escharotics with marked success, but only in a supplementary way. They may be used in cases where numerous small growths cover a large surface of the mucous membrane of the larynx.[1] I have occasionally employed nitric acid, but the escharotic which I have found most useful is "London paste" (Throat Hosp. Phar.). To all caustics and escharotics, however, the objection remains, that if sufficiently powerful to be effective, they are very likely to cause spasm of the glottis, or to give rise to inflammation of the adjacent mucous membrane; for this reason I now very seldom use them.

Galvanic Cautery.—Galvanic cautery may be carried out, either with knife-like instruments, or with loops. This plan of treatment was first practised by Professor Middledorpf,[2] and has since been very successfully carried out by Drs. Voltolini,[3] of Breslau, and other practitioners; but I cannot say that I have found it well adapted for the destruction of laryngeal growths.

Extra Laryngeal Methods of Removing Growths.—In certain cases, it unfortunately happens that growths in the larynx cannot be removed through the mouth.

The difficulty of laryngoscopic treatment may be due to the large size or extreme density of a growth, to its inaccessible situation, or extensive origin; to the occurrence of inflammatory tumefaction, or spasm of the glottis, on attempted evulsion through the mouth; to great irritability of the fauces, or to an unusually nervous and excitable state of the patient. In the case of very young children also, an extra-laryngeal method may be necessary.

The large size of a growth does not, in itself, call for external treatment, some of the largest growths having been removed *per vias naturales.*[4] The extreme density of a growth sometimes presents a great difficulty to laryngoscopic treatment, but with strong cutting forceps, this difficulty is only insuperable in the case of ecchondroses, and it is very questionable whether radical treatment should be attempted for their removal. The growth may be so situated that it cannot be completely eradicated from above. This occasionally happens in the case of growths springing from the anterior wall of the larynx below the vocal cords. In one of my cases of this sort, the evulsion was incomplete,[5] but in two others the tumor was entirely eradicated. When a growth, however, is situated in the ventricle, and only slightly projects from the ventricular orifice, it is sometimes impossible to remove it entirely from above. The projecting portion may be cut off, but the base remains.

The occurrence of inflammation or spasm of the glottis, on attempted laryngoscopic treatment, may render the *combined method* necessary (tracheotomy having first been performed, and evulsion being subsequently effected through the fauces), but it does not in itself justify an extra-laryngeal operation for evulsion.

An insuperable irritability of the fauces, or an extremely nervous condition of the patient, may, however, render laryngoscopic treatment impossible; and in these cases an extra-laryngeal treatment may be necessary. In the case of young children who cannot be taught to submit to laryngoscopic treatment, extra-laryngeal treatment may be required; but it must not be forgotten that very young children have been successfully treated with the aid of the laryngeal mirror.

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[1] Mackenzie: Ibid., Appendix A, Case 3. [2] Op. cit. [3] Op. cit.
[4] Mackenzie: Op. cit., Appendices A and C, Cases 3, 52, 92, 95, etc.
[5] Ibid., Appendices A and C, Case 24.

Contra-Indications for extra-Laryngeal Methods.—It may be stated as a cardinal law, that *an extra-laryngeal method ought never to be adopted* (even where laryngoscopic treatment cannot be pursued) *unless there be danger to life from suffocation or dysphagia.* Direct incision into any part of the air-passages is always attended with both immediate and remote danger to life, the amount of risk, however, not being great, as a rule. Dysphonia does not justify operations, which, though easy to perform, may be regarded as "capital." Hence an extra-laryngeal operation is not justifiable for the removal of a *small* growth in the larynx, unless that growth give rise to dangerous dyspnœa, and cannot be removed by a less serious method.

Contra-indications based on danger to life, having been thus briefly pointed out, it only remains for me to remark that destruction of the vocal function is often the result of any extra-laryngeal method.

Extra-laryngeal methods of extirpation may be carried out in one of three ways: 1st, By division of the thyroid cartilage, or thyrotomy; 2dly, by supra-thyroid laryngotomy, or division of the thyro-hyoid membrane; and 3dly, by infra-thyroid laryngotomy (through the crico-thyroid membrane), or tracheotomy.

Division of the Thyroid Cartilage, or Thyrotomy—History.—This important operation was first proposed for the removal of laryngeal growths by Desault, at the end of the eighteenth century. His remarks, which were perfectly true before the invention of the laryngoscope, are as follows: "In cases of polypi of the larynx, the indications are twofold; viz., the extirpation, or ligature of the growth, and the re-establishment of a passage for air; and they both necessitate laryngotomy. It rarely happens, indeed, that laryngeal excrescences project so far into the mouth, that they can be seized and extirpated or ligatured *per vias naturales.*" [1] The operation was not, however, carried out till the year 1833, when it was performed for the first time by Brauers of Louvain. Ten years later it was repeated by Ehrmann of Strasbourg. In 1851 it was practised by Gurdon Buck, and again by the same surgeon in the year 1861. The invention of the laryngoscope naturally gave an impetus to this operation.

Indications for Operation.—This operation may be required for the removal of large growths in the cavity of the larynx, which cause great dyspnœa or dysphagia, and cannot be removed with the aid of the laryngoscope; or for the evulsion of growths in the subglottic region, which cannot be extirpated by indirect laryngotomy (through the crico-thyroid membrane). It might be thought that this operation would be called for in the case of children; but the facility with which even very young children can be treated laryngoscopically has already been pointed out; and it must not be forgotten that when the larynx is small, thyrotomy is much more likely to lead to injury of the vocal cords.

Dr. Paul Bruns has successfully refuted the assertion that either the very large size, extremely hard consistence, unusually broad insertion, unfavorable situation, or multiplicity of the neoplasms, is, *a priori*, sufficient to contra-indicate a trial of the endo-laryngeal method. "It is only in certain rare exceptional cases," Paul Bruns observes, "*in which several of these unfavorable conditions occur together*, that we are entitled, *a priori*, to consider the attempt at removal *per vias naturales* as having no favorable prospect, *e. g.*, in some cases of solid tumors with very broad

[1] This quotation is taken from a later edition of Desault's Œuvres chirurgicales, by Bichat, Paris, 1812, vol. ii. p. 255.

bases situated below the glottis or originating in the ventricles." Here he shows, that out of 1,100 neoplasms, there were 602 papillomata, and 346 fibromata (constituting together 86 per cent. of all these growths); further, that 836 out of these growths originated from the vocal cords, while only three-fifths per cent. were situated below the glottis or in the ventricles. Consequently it is proved that three-fourths of all laryngeal growths are of such a nature and so situated, that they are well suited for endo-laryngeal interference. Whilst proving further by a good many examples, that growths springing from the under surface of the vocal cords, and those originating within the ventricles, have been and may easily be extirpated through the mouth if they are pedunculated, he, nevertheless, admits that *subcordal* or *ventricular* neoplasms, which have no pedicle, or are seated on a very broad base, or show an inclination to recurrence, belong to the department of laryngotomy. For the removal of subcordal growths, however, he recommends partial laryngotomy (cricotomy or cricotracheotomy with preservation of the thyroid cartilage), and only sanctions thyrotomy for the extirpation of tumors originating within the ventricles.

Method of Procedure.—The first question which arises is whether tracheotomy should or should not be performed as a preliminary measure of safety. I agree with Paul Bruns, "that previous or simultaneous tracheotomy, although it has been performed in by far the greater majority of the cases, is not required by the nature of the operation, unless there be other conditions necessitating its performance, such as dyspnœa." If tracheotomy is first performed, thyrotomy should not be at once carried out, but endo-laryngeal treatment should be carefully attempted when the tracheal canula has been worn for a few weeks. This failing, the surgeon may have recourse to the more severe treatment.

The incision for thyrotomy should be made exactly in the median line, through the textures over the thyroid cartilage, from the thyroid notch to the upper border of the cricoid cartilage. The thyroid cartilage should then be most carefully divided by a succession of small nicks, with a short, strong, sharp-pointed knife; but if ossification has taken place, the opening must be effected with a small circular or convex saw. If possible, the upper extremity of the projecting angle of the thyroid cartilage (pomum Adami) should be left intact, as the complete division of the cartilage in this situation is likely to be followed by changes in the relations of the vocal cords to one another, resulting in permanent aphonia. The instrument should not be allowed to penetrate the larynx until the whole of the cartilage is divided.[1] By this method the paroxysms of coughing, which otherwise interfere with the operation, are often avoided. When divided, the alæ of the cartilage should be kept widely apart by means of strong retractors held by two assistants, one on each side of the patient. The retractors should be like miniature pitch-forks, with the points blunted and bent round, so that they can hold back the alæ.

If the alæ cannot be thrown back, the crico-thyroid membrane should be divided along the lower edge of the thyroid cartilage, on one side, or, if necessary, on both sides. If there be still insufficient room, the thyro-hyoid membrane should be divided, by a horizontal incision along the upper edge of the thyroid cartilage. Horizontal division of the mem-

[1] This precaution is justly insisted on by Krishaber and Planchon (Faits cliniques de Laryngotomie, Paris, 1869, p. 93).

branes, however, is not generally necessary, and the thyro-hyoid should if possible be left intact.

The operator should now throw a strong reflected light into the opening, and, guided by it, and his previous laryngoscopic knowledge of the case, he will be able to seize the growth with a hook or forceps, and divide it with a pair of short-curved scissors. On account of the small space at the command of the operator, the growth may sometimes be cut through with a knife, without being previously seized, or it may be torn away with forceps. Sometimes, however, even after total division of the thyroid cartilage, the extensive attachments or dense consistence of the growth prevents its removal,[1] and the surgeon is obliged to desist from the operation. If all goes well, after the growth has been excised, its base should be firmly touched with solid nitrate of silver. Actual cautery, acid nitrate of mercury, and galvanic cautery, have all been used, but I prefer the nitrate of silver, as less likely to give rise to laryngitis, and quite as effectual when applied to a raw surface.

The two alæ of the thyroid cartilage should then be carefully brought together, in their exact normal situation, with two silver sutures, and the edges of the wound united with plaster. The canula should be allowed to remain in the trachea, for, at least, a few days, until all danger has passed off; or if there be any likelihood of recurrence, till further steps have been taken to effect complete eradication.

In some cases the cricoid cartilage has been divided, and though no harm appears to have resulted from its section, it is better, if possible, to leave it intact. Krishaber[2] justly remarks that division of the cricoid cartilage is altogether *unnecessary;* for whilst, on the one hand, it does not facilitate the removal of growths above the vocal cords, those below the glottis can easily be removed through an opening either in the crico-thyroid membrane or in the trachea.

Comparative Merits of Thyrotomy.—Unlike the operation conducted *per vias naturales*, the procedure now under consideratien is a very serious one, both as regards the danger to life and the risk of destruction of function.

In 1873[3] I published some articles on the results of thyrotomy, based on forty-eight cases, which comprised all then published. The following is a brief summary reduced to percentages, and placed in a tabular form:

	Per cent. on 48 cases.
Complete success[4]	14.58
Partial success	22.91
Death	8.33
Severe dyspnœa requiring use of canula	31.25
Severe dyspnœa requiring fresh operation	8.33

I have also tabulated the following other results, which are based on thirty-nine cases of *benign growth*, in which, the voice being affected before the operation, the patient survived more than a few days :

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[1] Paul Bruns: Op. cit., p. 167.

[2] Op. cit.

[3] Brit. Med. Journ., May, 1873.

[4] Complete success is understood by me to mean recovery of perfect voice and perfect respiration, and absence of recurrence of growth; partial success to mean recovery of one function with injury to another, or temporary recovery of both functions, but subsequent recurrence of the growth.

Aphonia	40.0	per cent.
Dysphonia	20.0	"
Modified voice	11.11	"
Not stated, but probably defective voice	6.66	"
Recurrence, or incomplete removal	38.46	"

The following are some of the conclusions which I arrived at:

(*a.*) That the operation ought never to be performed for loss of voice alone.

(*b.*) That the operation should be confined to those cases in which there is danger to life from suffocation or dysphagia, and even then should only be performed after an experienced laryngoscopist has pronounced it impossible to remove the growth *per vias naturales.* Dr. Paul Bruns [1] in his valuable work on the relative merits of thyrotomy and endolaryngeal operations for the removal of growths, remarks: "I quite agree with Mackenzie that 'laryngotomy is only justifiable when an experienced laryngoscopist *has declared the removal of the growth per vias naturales impossible*' (*Brit. Med. Jour.*, May 3, 1873, p. 488)—'only, I should say, *after he* (an experienced laryngologist) *has attempted the removal in vain.*'"

In order to thoroughly weigh the merits of thyrotomy, it is necessary to consider the prospects of the operation: (1), in relation to the preservation of life; (2), in relation to the recovery of voice; and (3), in relation to the immunity from recurrence. Each of these points will now be discussed in detail.

(1.) *In Relation to Life.*—In division of the laryngeal cartilages there is always some immediate danger. One patient died from secondary hemorrhage a few days after the operation, and several others have rapidly succumbed to pleurisy, pneumonia, or metastatic abscess of the lungs. In Dr. Cutter's case the patient was almost suffocated during the operation; and in one of Navratil's earlier cases, the hemorrhage was alarming, and the patient nearly died from the quantity of blood which passed down the trachea. In another of that surgeon's cases the patient suffered from high fever, and expectorated a quantity of blood and pus: œdema took place round the wound, and the patient was in a very critical state.

The usual risks attending the ordinary operations for opening the air-passages, are also, of course, present, and tracheitis or bronchitis may supervene. In addition to the immediate danger, there is also the contingent risk of chronic perichondritis at a later period.

(2.) *In Relation to Voice.*—In discussing this question, Bruns shows that the operation is very fatal to the vocal function. He takes exception to my statistics [2] on the ground that I have estimated the functional result *together with* that of the operation, in a general way, without stating whether the whole growth was removed, or whether recurrence took place or not—a method which naturally yields untrustworthy results. Bruns, therefore, carefully excludes from his statistics all those cases of final alteration or loss of voice in which this change could possibly be attributed to any other cause than the operation itself. Thus, out of the ninety-seven cases on record, thirty-eight only can be used for the decision of the question, whether the operation is, in itself, dangerous to the vocal function. Of the reality of this danger there can, however, be no doubt, for in 47 per cent. only (eighteen cases) out of these thirty-eight

[1] Op. cit.

[2] British Medical Journal, 1873, p. 488.

cases, was a normal or nearly normal voice restored or retained, while in twenty cases, the voice was either completely lost (six cases), or reduced to nearly complete aphonia or extreme hoarseness (fourteen cases). We see, therefore, that, in the majority of cases, the operation itself brings the vocal function into great danger.

(3.) *In Relation to Recurrence of Growth.*—It might be expected that extirpation could be more completely effected when the thyroid cartilage is divided, and the larynx thoroughly exposed to view, and that thus recurrence would be less frequent; but this supposition is not borne out by facts.

Dr. Paul Bruns has well pointed out, that the question of recurrence must be decided upon an examination of the cases of papilloma only; for fibromata do not recur, and the number of sarcomata operated on hitherto, is too small to permit of any satisfactory conclusion. Further, only those cases can be made use of which were under observation for a considerable time after the operation. Of Dr. Bruns's cases, one was only observed for five weeks, but most of them were kept in view for many months and even years. Distinctions of age must also be taken into account, children being separated for comparison from adults.

In the case of children Bruns[1] has collected seventeen instances of *thyrotomy*. Of these there were eight cures and nine recurrences. Out of forty cases treated by the *endo-laryngeal* method, twenty-six only were available. Among these we find thirteen cures and thirteen recurrences, but the latter number includes seven cases in which the growth had not been entirely removed, and which therefore do not properly belong to the category of recurrence. It must be admitted, however, that the cases of thyrotomy had *a priori* worse prospects than the others, the operation having been performed almost without exception in cases of *multiple papilloma*, and in the overwhelming majority of cases on children *under ten years*, while these unfavorable conditions were both present in only one-half of the cases treated *per vias naturales*.

In adults there were twenty-two cases of thyrotomy, with ten cures and twelve recurrences. Seventeen were cases of multiple, and five of solitary, papilloma. In the latter class recurrence took place only once, but in the former eleven times. With regard to the endo-laryngeal operation, on the other hand, after taking the above-mentioned precautions, there are only sixty-four cases, out of the great number on record, which can be used for these statistics. These sixty-four cases show forty-seven cures and seventeen recurrences. In thirty-one cases the papilloma was solitary (twenty-four cures and seven recurrences); in thirty-three multiple and diffuse (twenty-three cures and ten recurrences). Six of these cases were only cured after *repeated* operations.

These statistical tables show, therefore, that the frequency of recurrence after either method in adults and children together is as follows: (1.) Thyrotomy, thirty-nine cases, eighteen cures, twenty-one recurrences; (2.) Endo-laryngeal method, ninety cases, sixty cures, thirty recurrences, or, in other words, *whilst thyrotomy gives a few more recurrences than cures, the endo-laryngeal method shows twice as many cures as recurrences.* These numbers thoroughly refute the unfounded assertions of the partisans of thyrotomy.

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[1] Op. cit., p. 147 et seq.

The following is an abstract of Paul Bruns's conclusions on the more important matters:

(A.) Thyrotomy is not dangerous to life, nor difficult to perform, but it is, in itself, very dangerous to the vocal function. The pretended advantages as to the facility of its performance, the certainty of complete extirpation, and the security against recurrence, do not exist in reality.

(B.) Thyrotomy can therefore in no wise be placed on a par with the endo-laryngeal method, and is to be performed only if an experienced laryngoscopist has unsuccessfully attempted the endo-laryngeal operation.

(C.) Even in this case thyrotomy should not be performed if it can possibly be avoided, but partial laryngotomy (division of the crico-thyroid ligament, and, if necessary, of the cricoid cartilage and the superior tracheal rings), inasmuch as everything depends (so far as the restoration of function is concerned) on the question, whether the operation can be performed without the division of the thyroid cartilage (*i. e.*, the anterior commissure of the vocal cords).

(D.) In urgent cases, in which tracheotomy has to be performed for the relief of dyspnœa, thyrotomy should never be undertaken until removal by the endo-laryngeal method has been first attempted; and in these cases success may often be obtained by "partial" laryngotomy, the tracheal incision being prolonged through the cricoid cartilage.

(E.) If after endo-laryngeal removal of papillomata recurrence takes place, the same method ought to be tried over and over again, as there are many cases on record, showing that after frequently repeated operations complete cure was finally obtained.

On the subject of thyrotomy Dr. Fauvel[1] remarks, "I am extremely astonished to see surgeons, and still more so specialists in laryngoscopy, when they have only to deal with a simple polypus not menacing the life of the patient, still having recourse to this barbarous method, which consists in making an opening in the neck for extracting, by this dangerous, and often, too narrow way, tumors of a greater or less volume and consistence. The laryngoscope shows the polyp as plainly as possible; and also its seat, form, and size. It is therefore useless, not to speak more strongly, to establish, at the cost of a severe and bloody operation, an artificial opening into the larynx. This opening has no other result, I repeat, than to expose the polyp and permit an operation—two conditions which are completely fulfilled by the laryngoscope." He further proceeds to point out the danger of the operation from hemorrhage, and remarks that "in one case of thyrotomy, *he was obliged to apply thirty-eight ligatures*, though tracheotomy had been performed a month previously, and the patient wore the canula during the time the thyrotomy was being undertaken."

Removal of Growths by Division of the Thyro-Hyoid Membrane, or Supra-Thyroid Laryngotomy.—This method of treatment is indicated for the removal of large growths situated at the upper orifice of the larynx, which cannot be taken away *per vias naturales.*

The operation, originally proposed at about the same time by Malgaigne[2] and by Vidal de Cassis,[3] was first carried out in the year 1859.

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[1] Op. cit. pp. 227 and 229.

[2] The claim to originality is made by Malgaigne in his Manuel de Médecine opératoire, Paris, 1871, 7me édition, p. 525.

[3] Velpeau: Médecine opérat.

The operator was Dr. Prat, a surgeon in the French navy, stationed at that time at Papiete, the capital of Otaheite. The patient, who was the subject of advanced pulmonary phthisis, suffered also from such extreme difficulty of swallowing, that he could scarcely take any food. The dysphagia was due to a growth, which appears to have been situated on the under-surface of the epiglottis; it could be felt with the finger, but all attempts to seize and remove it through the mouth entirely failed. By operating after the manner recommended by Malgaigne, Dr. Prat easily removed the growth, which was of a compact fibrous structure and grayish white color. No vessels were tied. The wound healed quickly, and the symptoms from which the patient had suffered disappeared. He died shortly afterward from phthisis, and at the autopsy no trace of the growth was to be found.[1] In the year 1863 Follin[2] performed a similar operation with complete success. The neoplasms were extirpated, and the patient was entirely cured.

Transverse incision through the thyro-hyoid membrane should, according to Malgaigne, be made along the lower border of, and parallel with, the hyoid bone, through the skin, superficial fascia, the inner half of the sterno-hyoid muscles, the thyro-hyoid membrane, and the mucous membrane which extends between the base of the tongue and the epiglottis, and forms the glosso-epiglottic ligament. The side of the epiglottis should then be seized and drawn through the wound. The growth can then be removed, according to the circumstances of the case, by bistoury, scissors, or forceps. It may be stated that Follin divided the thyro-hyoid membrane along the upper border of the thyroid cartilage, that is, rather lower down than advised by Malgaigne, with a view of avoiding the epiglottis; and as far as I can gather from the report of his case, the incision was carried further outward than in Prat's case. The latter procedure certainly renders the epiglottis less likely to be wounded, but little immunity is afforded to the valve by making the incision a few centimetres lower down than recommended by Malgaigne. It must also be remembered that the more external the incision is carried, the greater is the danger of wounding important vessels. In any case, the hyoid branch of the thyroid artery is not unlikely to be wounded, but this is not a matter of any importance.

Although subhyoid laryngotomy is unattended with any considerable danger, either immediate or remote, I do not think that it will find much favor with those skilled in operating with the aid of the laryngeal mirror; for it happens that those cases which are favorable to the performance of this operation are just those which, as a rule, can be most easily treated through the mouth.

The operation is much less serious than thyrotomy, in relation to life, and is not attended with any risk to the vocal function. In operations involving the cartilages which form the framework of the larynx, there is, as has been already pointed out, always the danger of subsequent caries; but it is well known that injury of the elastic cartilages, though it may cause temporary inconvenience, is unattended with permanent risk. Not only do we frequently find that patients, recovered from tertiary syphilis, with the mere stump of an epiglottis, can swallow perfectly well; but it has already been proved, in the celebrated case of Prince

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[1] Gazette des Hôpitaux, 1859, No. 103, p. 809.
[2] Archives Générales de Médecine, Février, 1867.

Murat,[1] that the epiglottis may be suddenly cut away with only temporary inconvenience. Again, most hospital surgeons must have frequently met with extensive suicidal wounds of the thyro-hyoid membrane involving the epiglottis, which have healed rapidly without any bad results. This last fact has been illustrated by some remarkable cases by Künst.[2]

Removal of Growths by Infra-Thyroid Laryngotomy (through the Crico-Thyroid Membrane), or by Tracheotomy.—This mode of eradicating growths was recommended by Professor Czermak in the year 1863; but it was first successfully employed two years later by Dr. Burow, senior,[3] of Koenigsberg. In the year 1869 it was carried out, for the second time, by myself.[4] Since then eleven other cases have been placed on record, all of which are briefly detailed in Paul Bruns's work. The operation is recommended for the removal of laryngeal growths situated in the subglottic region, as well as for tumors in the upper part of the trachea, when, in such cases, laryngoscopic treatment cannot be carried out. Paul Bruns strongly recommends this operation for the extirpation of tumors originating from the free borders and the lower surface of the vocal cords or from below the glottis. If they are small and pedunculated, the crico-thyroid membrane alone, or the cricoid cartilage in addition, may be divided, but only if previous endo-laryngeal attempts at removal have been unsuccessful; if the growths are large, and attached by a broad base, laryngo-tracheotomy should be adopted, without any endo-laryngeal attempts, as by this operation alone a thorough cure can be expected.

A few days before evulsion is attempted, an incision should be made as in ordinary (crico-thyroid) laryngotomy, but the crico-thyroid opening should be carefully dissected out, and all the membrane, muscle, and superficial parts removed, so that nothing is left but the two cartilages surrounding the opening; a canula should then be inserted. When all disposition to hemorrhagic oozing has ceased, and all tenderness disappeared, the canula should be taken out, the chin thrown well back, so as to enlarge the crico-thyroid space as much as possible, and a careful examination made with one of Neudörfer's infra-glottic mirrors, to ascertain the exact origin of the growth. The mirror must then be laid aside, and the growth removed with short tube-forceps.

This operation can only be performed where the crico-thyroid membrane is of average size; if there is not room to effect removal, tracheotomy should be performed in the first instance instead of laryngotomy. The steps of the operation are almost the same as in (crico-thyroid) laryngotomy. When the patient has recovered from the tracheotomy, that is to say, a few days after the operation, the canula should be removed, and an attempt made to extirpate the growth. In carrying out the operation, the two sides of the windpipe require to be held back with retractors, in order that instruments may be conveniently passed into the larynx.

The patient should continue to wear the canula for a few months, or, at any rate, for a few weeks, in case eradication be incomplete, or recurrence take place.

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[1] In this historical case, which occurred at the battle of Aboukir, half of the epiglottis was carried away by a musket-ball. Under Baron Larrey's treatment the patient recovered. Another similar case occurred in the same campaign, with an equally fortunate result. (Larrey: Clinique chirurg., t. ii. p. 142; Relation chirurg. de l'Armée d'Orient, p. 286. quoted by Ryland.)

[2] Eröff. der oberst. Luftwege, Leipzig, 1864, p. 45.

[3] Deutsche Klinik, vol. xvii. p. 165.

[4] Op. cit., Case 81.

[MALIGNANT TUMORS OF THE LARYNX.

Under this head are included (1) Carcinomata, and (2) Sarcomata.]

CANCER OF THE LARYNX.

Latin Eq.—Carcinoma laryngis.
French Eq.—Cancer du larynx.
German Eq.—Krebs des Kehlkopfs.
Italian Eq.—Cancro della laringe.

Definition.—Primary cancer of the larynx, giving rise to hoarseness, dyspnœa, pain in the throat (darting to the ears), sometimes to dysphagia, and ultimately causing death either by marasmus, or, if tracheotomy has not been performed, by apnœa.

Etiology.—The cause of cancer of the larynx, as of malignant disease in general, has not yet been discovered. With respect to age, like the same disease in other parts, it is more frequent in advanced periods of life. The following table of 53 cases occurring in my practice illustrates this point. It will be seen that nearly the whole of the mortality (*i. e.*, 83 per cent.) takes place between the ages of forty and seventy.

	Cases.
From 10 to 20 years of age	1
" 20 to 30 "	2
" 30 to 40 "	6
" 40 to 50 "	10
" 50 to 60 "	18
" 60 to 70 "	15
" 70 to 80 "	1

Ziemssen[1] publishes a table of 76 cases, collected from various authors, which gives very similar results, but includes 3 cases under nine years of age and 3 between the ages of ten and nineteen.

As regards sex, 42 of my cases were men and 11 women, whilst of Ziemssen's 76 collected cases 60 were males and 16 females. In 44 cases of laryngeal cancer observed by Fauvel,[2] the relative distribution with respect to age and sex is almost identical.

Symptoms.—The subjective symptoms of cancer of the larynx are not of a very distinctive character. Pain, dyspnœa, and dysphagia are generally present, but these symptoms vary according to the stage and exact site of the disease. My experience accords with Fauvel,[3] who states that at first the pain is confined to the larynx, and that not until ulceration has commenced does it radiate to the ears, orbit, and forehead. Pain is sometimes felt in the submaxillary and cervical glands, but this is comparatively rare.

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[1] Cyclopædia of Medicine, vol. vii. p. 891.
[2] Traité pratique des Maladies du Larynx, Paris, 1876, p. 683 et seq.
[3] Ibid. p. 707.

Objectively, the groups of symptoms presented by laryngeal cancer are striking, and almost always sufficiently characteristic to enable the observer to arrive at a definite opinion as soon as the disease has begun to develop organic changes. Hoarseness, sometimes due to implication of the recurrent nerve, is a very early symptom, and sometimes precedes all other symptoms by months or even years. The disturbance of phonation is of course progressive, but, as Dr. Fauvel has pointed out, the voice is seldom entirely lost, as it is in laryngeal phthisis, and by an effort the patient can generally succeed in producing a vocal sound. As soon as ulceration takes place there is fetor of the breath, and this is in itself a strong indication of the nature of the malady. As ulceration advances another symptom—hemorrhage, which when serious is almost pathognomonic of cancer—may be met with. There may be copious bleeding from one or more small vessels being laid open, or the bloody discharge may only be sufficient to tinge the expectoration, which in almost all cases consists of ichorous muco-pus.

The external condition of the neck seldom affords any evidence as regards laryngeal cancer. Occasionally, however, at an advanced stage of the disease, the submaxillary glands are enlarged, and in some rare cases, owing to intra-laryngeal tumefaction, the alæ of the thyroid cartilage are pressed outward, so that, as Isambert[1] has pointed out, the cartilage feels very much like a "crustacean carapace." More rarely still, the cancer eats through the integument.

As regards the general condition of the patient in laryngeal cancer, the essential cachexia does not present itself so uniformly as in malignant disease of other parts. This can readily be explained by the fact that the

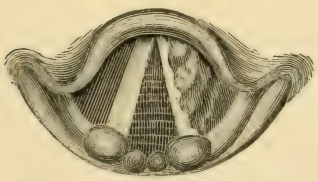

FIG. 61.—Epithelioma of the Left Ventricular Band.

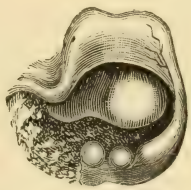

FIG. 62.—Epitheliomatous Ulceration of the Right Ary-epiglottic Fold and Thickening of the Epiglottis.

connection of the lymphatics with the glandular system is not nearly so free as in the pharynx and other parts (see page 155). Where, however, life is much prolonged, as in those cases in which swallowing is little interfered with, and tracheotomy has been performed at an early period, the characteristic cachexia is sometimes present. I only know of one instance in which cancer has developed secondarily in other parts of the body—the original disease having been in the larynx.

The laryngoscopic appearances vary according to the stage of the disease. At first the neoplasm appears as an undefined swelling, without any features which clearly indicate its nature. The site of the tumor is in most cases one of the ventricular bands (Fig. 61), but in some instances one of the vocal cords, the epiglottis, or the ary-epiglottic folds, have been the first part to be attacked. Any part of the larynx may, however,

[1] Annales d. Malad. de l'Oreille et du Larynx. T. ii. p. 8.

suffer from the encroachment of the morbid growth, so that after a time it becomes impossible to decide at what point it commenced (Fig. 62). Sometimes the growth covers the entire larynx, as in certain cases of diffuse epithelioma (Fig. 63).

When the disease attacks the epiglottis it often causes so much general swelling, that the interior of the larynx cannot be seen; but occa-

FIG. 63.—Diffuse Epithelioma.

FIG. 64.—Epithelioma of the Epiglottis.

sionally it slowly eats away the cartilage without causing any tumefaction. This is well shown in a case exhibited by me some years ago at the Pathological Society (Fig. 64).

The following table shows the site of the disease in my 53 cases of primary laryngeal cancer, when the patients first presented themselves, or when the disease became manifest:

	Times.
The right ventricular band	15
The left ventricular band	13
The left vocal cord	3
The left vocal cord and subglottic region	2
The right vocal cord	2
The anterior commissure of the vocal cords	2
The epiglottis	6
The posterior surface of the cricoid cartilage	1
The whole of larynx	9

It will be seen that in 56.7 per cent. of cases, one of the ventricular bands was the part first affected.

Both Fauvel [1] and Ziemssen [2] illustrate the question as to the site of cancer of the larynx by reference to their cases. Thus in 37 cases observed by the former physician, 26 occurred on the left side, and of these the ventricular band was first affected in 16. Ziemssen thinks that the vocal cords or the ventricles of Morgagni are the usual points from which the growth spreads upward to the ventricular bands and ary-epiglottic folds.

In the encephaloid variety of the disease the tumor appears in single nodules and ulcerates early. As soon as ulceration is established a process of sprouting commences, and as Fauvel has well pointed out, the vegetations issue *from the ulcerated surface*, and do not attack the surrounding mucous membrane, which remains more or less intact for some

[1] Op. cit. p. 693.

[2] Op. cit. p. 891.

time, being but slowly eaten away by the gradual spreading of the primary ulcer. On the other hand, in epithelioma, as soon as an ulcer has formed, a series of vegetations spring up *about its margins*, and these new growths, by ulcerating in their turn, rapidly increase the original loss of substance. In scirrhus the disease in the earliest stage has much the appearance of a benign growth—a smooth papilloma or fibroma—but the surface of the growth and the neighboring mucous membrane soon become inflamed, and in a short time distortion of some part of the larynx may be observed. From the foregoing remarks it will be understood that the laryngoscopic picture of a fully developed case of ordinary laryngeal cancer is that of a neoplasm, variable in size, single or multiple, whose surface is in a state of fungous ulceration, and frequently bathed in a purulent secretion or a sanguineous muco-pus.

In the only case of adenoid cancer that I have met with (Fig. 65), the disease commenced with ulceration of the epiglottis, and from this spot a nodulated growth about the size of a cherry developed.

Pathology.—Epithelioma is by far the most common form of cancer which affects the larynx. Out of my 53 cases,[1] 45 were epitheliomatous (one of these adenoid), 2 scirrhous, and 6 encephaloid. In 68 cases collected by Ziemssen, 57 were examples of epithelioma, 9 encephaloid or scirrhous, and 2 villous. Fauvel,[2] however, in 39 cases met with different results, there having been 19 examples of encephaloid disease, 16 of epithelioma, and 2 doubtful cases. Schroetter[3] has reported twenty cases of cancer, 17 of which were examples of epithelioma, and 3 of encephaloid. In 10 out of 32 cases on which I made a post-mortem, the cartilages were necrosed ; but I believe that these structures are affected in a much larger proportion of cases than these figures indicate. The condition of the cartilages cannot, however, be ascertained without destroying the specimen for museum-purposes, and this consideration has unfortunately prevented me from satisfactorily arriving at any conclusion on the subject. There was some œdema in every fatal case, as well as in 11 out of 21 cases seen only during life.

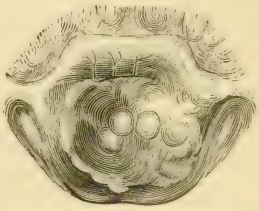

FIG. 65.—Adenoid Cancer.

Diagnosis.—In the early stages of laryngeal cancer the diagnosis is often doubtful, but as soon as a tumor is formed, the experienced laryngologist can nearly always roughly determine its character. The appearance of a considerable but irregular and undefined swelling of a dirty gray or bright red color on one of the ventricular bands, in a patient past the middle period of life, without any history of syphilis or previous severe chronic laryngitis, should raise grave suspicions of malignant disease.

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[1] In only 27 of the cases of epithelioma, and in only 3 of the cases of encephaloid disease, was the disease verified by post-mortem examinations. In both the cases of scirrhus the diagnosis was confirmed by microscopical examination. The paucity of autopsies is to be explained by the fact that we often lose sight of our cancerous patients as the fatal issue approaches. On this subject, Isambert, (Op. cit. p. 3) judiciously remarks: "Hospital patients suffering from cancer are not like the tuberculous; the former make no mistake as to their prospects, and disappear from our notice to die in their own homes." Thus it happens that we are so often deprived of the means of verifying our diagnosis.

[2] Op. cit. p. 689.

[3] Laryngol. Mittheilungen, Wien, 1875, pp. 65 and 70.

Similar conditions in other parts of the larynx will likewise call for close observation. As soon as the tumor ulcerates, the fungous character of the sore is usually very characteristic, but nevertheless in no case should the patient be condemned as suffering from cancer until all doubts have been cleared up by the trial of antisyphilitic treatment.

Prognosis.—As far as the present state of our knowledge extends, the only possible termination of any case of cancer is death, but at the same time the question must always arise as to how long life may last in any particular instance. The usual duration of epithelioma of the larynx appears to be about eighteen months, and of encephaloid three years; in the cases which have been reported as lasting for ten or fifteen years,[1] I cannot imagine that the disease was malignant from the commencement. On the other hand, patients often perish in a few months through some untoward event, such as acute œdema, perforation into the œsophagus, or lung complications.

Treatment.—Endolaryngeal treatment, thyrotomy, extirpation of the larynx, and tracheotomy are the various procedures which must be considered.

As regards *endolaryngeal treatment*, it need only be remarked that the radical removal of an ill-defined tumor cannot be efficiently accomplished by this method.

The results of *thyrotomy* have been shown by Dr. Paul Bruns[2] to be as follows:

In twenty cases in which thyrotomy was performed for the removal of malignant growths (most of which were epitheliomata), death ensued after a few days in 2 cases. In the remaining 18[3] cases there was immediate recurrence in 4 cases, and recurrence a fortnight after the wound had healed in four cases; there was recurrence after from two to four months in 3 cases, after from five to six months in 2 cases, and within eighteen months in one case; the result was not reported in 3 cases. In the remaining single case no recurrence followed for a considerable time. It is true that death occurred twenty-two months after the operation from carcinoma of the left kidney and left suprarenal body, but there was no trace of recurrence in the larynx. The functional result was unfavorable in all these cases. It will thus be seen that the results of thyrotomy are extremely unsatisfactory. In some cases the operation was followed by immediate death, in others it could not be completed, and in the remaining cases, with two exceptions only, recurrence followed within a very short time. If the few statistics which have been collected are to be trusted, the average duration of life after the operation is only ten months. The mode of performing thyrotomy has already been explained (see page 237), but it may be remarked here that, in order to obtain any chance of success by this operation, every particle of the morbid growth must be excised, and the resulting wound well cauterized with nitrate of silver, or even by the actual cautery.

According to Fauvel,[4] *tracheotomy* always adds several months and often even a year or two to the patient's existence. Thus in 7 cases of encephaloid left to their own course, the average duration of life was three

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[1] See Ziemssen's table: Op. cit. p. 899.

[2] Op. cit.

[3] Paul Bruns, op. cit. (p. 73), says *seventeen* cases, but there actually appears to have been eighteen.

[4] Op. cit. p. 716.

years, whilst in 8 similar cases subjected to tracheotomy the mean of life was three years and nine months. Again, in 6 cases of epithelioma not tracheotomized, the average duration was one year and eleven months, whilst in 7 cases which were operated on the patients lived on an average four years.

In cases which seem suitable, recourse may be had to *extirpation of the larynx*, but this operation should only be undertaken at the immediate request of the patient after the subject has been fully explained to him in all its bearings.

The following description, for which I am mainly indebted to Dr. Foulis,[1] shows how extirpation should be effected :—A vertical incision should be made from the hyoid bone to the second ring of the trachea, and the front and sides of the larynx should be thoroughly freed and exposed by careful dissection, partly with the cutting blade of the scalpel, but as far as possible with its handle. Should there be any decided arterial hemorrhage, the necessary ligatures must be applied. The trachea should be then drawn forward with a hook and cut across, care being taken to avoid penetrating the œsophagus ; a syphon tube of vulcanite is then to be inserted into the windpipe. (In order that the syphon may fit accurately, it is well to have at hand several tubes of different sizes.) The upper and posterior attachments of the larynx should next be cut through, and in dissecting out the cricoid cartilage the risk of button-holing the gullet must be avoided by keeping the knife close to the cartilage. Sometimes the whole of the larynx must be taken away, but in Dr. Foulis's case he was able to spare the superior cornua of the thyroid cartilage and half the arytenoid cartilages. If there is much hemorrhagic oozing from the raw surface it may be gently swabbed with a styptic solution ; but local applications are, if possible, to be avoided, as they are apt to excite reflex irritation and cause retching. When the surfaces have healed and the gap in the throat has contracted to some extent, Gussenbauer's artificial vocal apparatus (*see* Tracheal Instruments) may be used.

The operation, however, is not always of so simple a character as it has been described, for when the surgeon has made some incisions he may find that the disease is much more extensive than was previously supposed. Thus in one case Langenbeck was obliged to tie 40 arteries, to divide the lingual and hypoglossal nerves on both sides, and to cut away the two submaxillary glands and a large portion of the posterior half of the tongue. In a case of Billroth's, it was found necessary to remove the larynx, the three upper rings of trachea, the thyroid gland, the lower part of pharynx, and a large portion of the œsophagus. Extirpation of the larynx is in fact an operation in which, as Dr. Paul Koch[2] points out, "the skill of the surgeon is, in some cases, shown by the patient not dying under his knife."

The following analysis of the annexed tables (pp. 251—254) shows the result of all the operations which have been performed up to the present time : Of nineteen cases operated on, one patient died six weeks after the operation from pericarditis, resulting from the passage into the mediastinum of a bougie, used for dilating the œsophagus, which had undergone cicatricial contraction as a result of the operation ; eight patients died from collapse or pneumonia within a fortnight—in other words, directly after the operation, viz., 1 on the 2d day, 1 on the 3d day, and 1 on the 4th

[1] Lancet, October 13, 1877.
[2] Annales de l'Oreille, etc., March, 1879.

day; 2 on the 5th day, 1 within "a few days," 1 on the 11th day, and one within 14 days. In seven instances recurrence took place within a few months after the operation, viz., once in 3 months, once in 4 months, twice in 6 months, and once each in 7 months, 9 months, and 10 months respectively. Three cases were cured, one of which was an example of carcinoma and two of sarcoma; in one of the latter cases the patient died 18 months after the operation from pulmonary and tracheal phthisis. In these three cases the disease was absolutely confined to the larynx, whilst in many of the others the neighboring tissues were also involved. It has already been shown that, owing to the arrangement of the lymphatic system in the larynx, disease of that part does not quickly infect the constitution. This fact favors the prospects of extirpation of the larynx, when the neoplasm is confined to its cavity. In any case, the rescue of three patients out of 19 (15.7 per cent.) from certain death must be regarded as one of the greatest triumphs of modern surgery.

Reviewing the whole subject of treatment, our aim must be to prolong life when possible, and in every case to promote the euthanasia when the inevitable end draws near. From the foregoing remarks it will appear that the first indication can best be fulfilled by resorting to tracheotomy before the constitution has suffered from the impediment to free respiration. When deglutition is much interfered with, the patient must be fed by means of the œsophageal-tube, or by nutritive enemata. In order to relieve pain insufflation of morphia (gr. $\frac{1}{4}$ to $\frac{1}{2}$ mixed with powdered starch) may be employed once or twice daily with great advantage. By such topical applications alone it is often possible to keep the sufferer almost free from pain; whilst at the same time swallowing is rendered easy, and the appetite frequently improves. Whatever means we may adopt for the treatment of the local disease, it must not be forgotten to supplement them by general tonic and analeptic measures; and by well-considered dietetic and hygienic treatment an attempt should be made to preserve the integrity of the constitution as long as possible.

Secondary Cancer.

This affection scarcely deserves the name here used, my experience being similar to that of Dr. Fauvel, who remarks that he has never met with a case of secondary cancer of the larynx originating in infection.[1] It is very common, however, to find cancer involving simultaneously the posterior wall and sides of the œsophagus or lower portions of the pharynx, and at the same time the mucous membrane covering the posterior surface of the cricoid cartilage. Occasionally, also, cancer commencing in the sides of the pharynx or root of the tongue extends to the epiglottis or ary-epiglottic folds. These are, in fact, illustrations of the *contiguous* extension of the disease, and have been sufficiently considered under Cancer of the Pharynx (page 60 et seq.).

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[1] Op. cit. p. 748.

No.	Name of Surgeon.	Date of Operation.	Patient's Age.	Patient's Sex.	Character and Situation of the Growth.	Part Removed.	Immediate Result.	Further Result and Remarks.	Described in
1	Billroth (Vienna).	1873, 31st Dec.	36	Male.	Carcinoma of the larynx.	Part of the two upper tracheal rings, cricoid, thyroid, both arytenoid cartilages, and lower third of the epiglottis.	Recovery.	Death from recurrence of the carcinoma, 7 months after operation. No P.M.	"Archiv für Klin. Chirurgie," Band xvii. Heft ii. p. 343.
2	Heine (Prag).	1874, 28th Apr.	50	Male.	Carcinoma of the larynx.	Larynx in toto.	Recovery.	Death from recurrence of the disease 6 months later.	"Archiv für Klin. Chirurgie," Band xix. p. 584.
3	M. Schmidt (Frankfurt).	1874, 12th Aug.	56	Male.	Carcinoma of the larynx.	Cricoid, thyroid, and both arytenoid cartilages.	Death on the 5th day after operation from collapse.		"Archiv für Klin. Chirurgie," Band xviii. Heft i. p. 189.
4	Maas (Freiburg). (At that time in Breslau.)	1874, 1st June.	57	Male.	Adeno-fibroma carcinomatosum.	Larynx in toto.	Death 2 weeks after operation from pneumonia.		"Archiv für Klin. Chirurgie," Band xix. p. 507.
5	Schönborn (Konigsberg).	1875, 22d Jan.	72	Male.	Carcinoma of the larynx.	Larynx in toto.	Death a few days after operation.		"Berliner Klinische Wochenschrift," 1875, No. xxxviii. p. 525.
6	Bottini (Turin).	1875, 6th Feb.	24	Male.	Sarcoma of the larynx, partly round-celled, partly spindle-celled.	Larynx in toto.	Cure. This patient in May, 1878, was perfectly well, working in the fields, and acting as a postman between Miazzina and Trabaro. (Letter from Signor Domenico Barozzi, Sindaco of Miazzina.)	This is the most successful case on record, the patient having been able to undergo considerable bodily labor after the operation.	"Communicazione letta Innanzi, La R. Academia di Medicini di Torino" dal Prof. E. Bottini. Seduta del 30 Aprile, 1875.

EXTIRPATION OF THE LARYNX.—*Continued.*

No.	Name of Surgeon.	Date of Operation.	Patient's Age.	Patient's Sex.	Character and Situation of the Growth.	Part Removed.	Immediate Result.	Further Result and Remarks.	Described in
7	v. Langenbeck (Berlin).	1875, 21st July.	57	Male.	Carcinoma of the upper part of the larynx, the epiglottis, and the hyoid bone.	Larynx in toto, hyoid bone, part of the tongue, pharynx, and œsophagus.	Recovery.	Death 4 months after the operation from recurrence of the carcinoma in the lymphatic glands of the neck.	"Berliner Klinische Wochenschrift," 1875, No. 33, p. 453; and "Archiv für Klin. Chirurgie," vol. xxi. Supplementband, p. 136.
8	Billroth (Vienna).	1875, 11th Nov.	54	Male.	Carcinoma of the larynx (diagnosed by Prof. Schroetter) affecting the organ generally.	Larynx in toto.	Death on the 2d day after operation from croupous pneumonia.		Information communicated by Dr. Mulhall, in reply to inquiries made in Vienna in March, 1878.
9	Maas (Freiburg).	1876, 5th Feb.	50	Male.	Epithelioma of the larynx.	Larynx in toto, with exception of the epiglottis and of a small piece of the cricoid cartilage.	Recovery.	About 3 months later, recurrence of the disease in the posterior part of the tongue. No operation allowed. Death 6 months after the first operation from hemorrhage from the ulcerated carcinoma.	"Archiv für Klin. Chirurgie," Band xx. p. 535; and private communication by Prof. Maas.
10	Gerdes (Jever).	1876, 30th Mar.	76	Male.	Carcinoma.	Larynx in toto.	Death on the 4th day from collapse.		"Archiv für Klin. Chirurgie," Band xxi. Heft ii. p. 473.

11	Reyher (Dorpat).	1876, May.	60	Male.	Carcinoma of the vocal cords.	Larynx in toto, with exception of the epiglottis.	Death on the 11th day after operation from hypostatic pneumonia.		"St. Petersburger Medicinische Wochenschrift," 1877, Nro. 17 and 18.
12	Kosinski (Warsaw).	1877, 15th Mar.	36	Female.	Epithelioma of the larynx, with perforation of the skin.	Larynx in toto.	Recovery.	The patient died 9 months after the operation, recurrence of the disease having taken place.	"Centralblatt für Chirurgie," Nro. xxvi. 1877, p. 401, and private communication by Dr. Kosinski.
13	Foulis (Glasgow).	1877, 10th Sept.	28	Male.	Partly papilloma, partly spindle-celled sarcoma.	Larynx in toto, with exception of the superior cornua of the thyroid cartilage and half of the arytenoid cartilages.	Cure.	Death from tracheal and pulmonary phthisis, March 1, 1879.	"Lancet," Oct. 13, 1877, and March 29, 1879.
14	Wegner (Berlin).	1877, 16th Sept.	52	Female.	Carcinoma of the larynx, originating from the right ventriculus Morgagni, size of walnut.	Larynx in toto, with exception of epiglottis and upper half of the cricoid cartilage.	Cure. At the time of communication (7 months after operation) no recurrence.	Exhibited at the Congress of German Surgeons, Berlin, 1878, on the 12th of April.	Private communication by Dr. Wegner.
15	Bottini (Turin).	1877, 29th Aug.	48	Male.	Epithelioma of the larynx.	Whole of larynx and portion of œsophagus.	Death on the 3d day from double pneumonia.	Bloodless operation, having been entirely carried out with the galvano-cautery knife.	"Annales des Maladies de l'Oreille et du Larynx," July 1, 1878.

EXTIRPATION OF THE LARYNX.—*Continued.*

No.	Name of Surgeon.	Date of Operation.	Patient's Age.	Patient's Sex.	Character and Situation of the Growth.	Part Removed.	Immediate Result.	Further Result and Remarks.	Described in
16	v. Bruns, senior (Tübingen).	1878, 29th Jan.	54	Male.	Epithelioma of the larynx.	Entire larynx.	Recovery.	Preliminary tracheotomy was not performed. Died Nov. 1, 1878, from recurrence.	"Wiener Med. Presse," Nov. 17, 1878. Further communication from Professor Paul Bruns.
17	Rubio (Madrid).	1878, 11th May.	41	Male.	Necrosis of the cartilages of the larynx.	Entire larynx.	Death on the 5th day after the operation from marasmus.		"Observacion Clinica," etc. Real Academia de Med. Madrid, 1878.
18	Billroth.	1878, 7th July.	50 Abt.	Male.	Epithelioma of larynx from left vocal cord to cricoid cartilage.	Left half of larynx.	Recovery.	Recurrence after six months.	Private communication by Professor Billroth.
19	Billroth.	1879, 27th Feb.	43	Female.	Epithelial cancer of the pharynx, larynx, and thyroid gland.	Entire larynx, with part of pharynx and œsophagus.	Recovery.	Death from passage of bougie into mediastinum after six weeks.	Private communication by Professor Billroth.

Sarcomata.

Sarcomata constitute a variety of growth, which is comparatively infrequent in the larynx, only five cases[1] having come under my notice. These growths may originate from any part of the mucous membrane of the larynx, and in one instance I met with a tumor of this kind (Fig. 66) situated on the posterior surface of the cricoid cartilage. Two of my cases occurred in men aged respectively sixty-four and forty-two; the others in women, aged respectively fifty-three, forty-three, and thirty-seven. In one of these dysphonia had existed for twenty-three years. As a rule sarcomata rapidly attain a considerable size,[2] so much so, that in a relatively large proportion of the cases either thyrotomy or extirpation of the larynx has been found necessary. In one of my cases the surface of the growth was quite smooth, but in the others it was mammillated. The color is generally red, but in one instance it was partly yellowish,[3] and in another case it was darker than that of the neighbor-

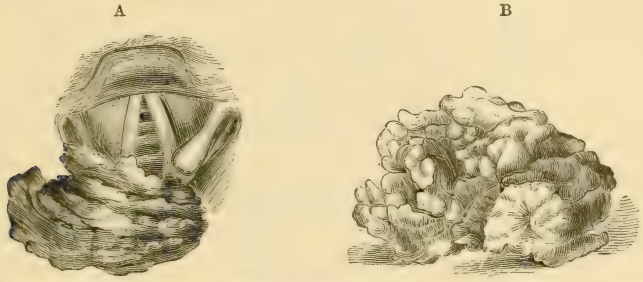

Fig. 66.—Sarcoma growing from the Posterior Surface of the Cricoid Cartilage: A, the growth *in situ*; B, the growth after removal.

ing mucous membrane. During life these tumors often cannot be distinguished by their appearance from papillomata, and even after death, if extensive ulceration has taken place, the naked-eye appearances cannot be relied on. The true character of the disease cannot in fact be determined with certainty except by the microscopical examination of a portion of the neoplasm.

These growths generally partake of the spindle-celled or fascicular character, but I recently met with an example of round-celled sarcoma, and the following is the microscopical report by Dr. Stephen Mackenzie: "Sections show the whole of the tissues infiltrated with small, round cells, completely filled by a nucleus, and with very scanty and delicate reticulum. The cells are most numerous in the submucosa, where they pass in dense masses between the bundles of striated muscular fibres, and surround the blood-vessels and nerves. They do not much encroach on the mucosa. The epithelium covering the surface is in some places intact, but thickened; in other places it is irregular, as though eroded and undergoing

[1] Op. cit. Appendix A, Nos. 59, 49, and 95, and Trans. Path. Soc., vol xxi. The fifth case was that of a man, aged 64, whom I lately saw with Dr. Strong, of Croydon.

[2] Balassa: Wien. Med. Wochenschrift, No. 92, 1868; also Ruppaner: New York Med. Journ., March, 1870; and Schroetter: Laryngol. Mittheil, Wien, 1875, p. 71.

[3] Laroyenne: Gazette hebdom., 1873, p. 780.

proliferation. Nowhere are there epithelial protrusions into the mucosa. Some reticulated cartilage is cut across in the sections, and the cartilage cells have fallen out; the nuclei of the fibres are unusually distinct."

The prospects of the patient are much less satisfactory than in the case of benign growths, but more favorable than when cancer is present. In one case I succeeded in permanently removing the growth *per vias naturales*,[1] and Navratil,[2] Gottstein,[3] Türck,[4] and others have effected cures in this way. On the other hand, Balassa[5] attained success by thyrotomy, and Bottini[6] and Foulis[7] both restored their patients to health by extirpating the larynx.

If the growth cannot be entirely removed by intra-laryngeal treatment, either thyrotomy or extirpation of the larynx must be selected according to the site and extent of the growth.

SYPHILIS OF THE LARYNX.

Latin Eq.—Syphilis laryngis.
French Eq.—Syphilis du larynx.
German Eq.—Syphilis des Kehlkopfs.
Italian Eq.—Sifilitide della laringe.

Definition.—The local manifestations in the larynx of constitutional syphilis, constituting the so-called secondary, tertiary, or hereditary phenomena, and giving rise to dysphonia or aphonia and sometimes to dyspnœa.

Etiology.—The precise causes which predispose the larynx to an attack of syphilis are not clear; but in many cases the disease is probably attracted to the part through local weakness, either hereditary or acquired. The season of the year has a marked influence in causing the outbreak to take place in the laryngeal mucous membrane in the early stages, and to a less extent later on. Thus out of 118 cases of secondary syphilis, of which I have notes, 79 commenced between September 1st and March 31st, and only 37 between April 1st and August 31st, whilst out of 110 cases of tertiary syphilis 66 commenced in the six winter months, and 44 in the summer months.

With respect to the frequency with which syphilis affects the larynx as compared with other parts, the statistics of Williglk[8] show that out of 218 cases of syphilis in the dead subject, in 15.1 per cent. there was disease of the larynx, in 10.1 per cent. the pharynx was affected, whilst the nose suffered in 2.8 per cent. Other observations give a somewhat different result. Out of 521 cases Engelsted[9] found the larynx affected only 25 times. In 1,000 syphilitic patients Lewin[10] diagnosed a laryngeal affection

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[1] Mackenzie: Op. cit. Case 95.
[2] Berlin. Klin. Wochenschrift, 1868, No. 49, p. 501.
[3] Wiener Medizin. Wochenschrift, Dec. 30, 1868, No. 105.
[4] Op. cit. pp. 576, 577.
[5] Loc. cit.
[6] Loc. cit.
[7] Loc. cit.
[8] Prager Vierteljahrschrift, xxiii. 2. p. 20, 1856.
[9] Virchow and Hirsch's Jahresbericht. Bd. ii. 1868, p. 585.
[10] Die Behandlung der Syphilis, Berlin, 1869.

in 44. These figures are thus widely discrepant, and do not give any definite reply to the question at issue. In 10,000 consecutive cases of throat disease examined at the Throat Hospital, I found 308 cases of laryngeal syphilis, as compared with 834 in which the pharynx was affected. (See Table A.)

With respect to age, most cases of laryngeal syphilis occur between twenty and forty, as will be seen on reference to Table B. Again, as regards the kind of syphilis most frequently met with in the larynx, Table A shows that tertiary phenomena are more common than secondary, being in the proportion of eighteen to eleven. From this it would appear that the larynx is most liable to be affected in patients in whom the constitutional malady has been of long standing. My colleague, Dr. Whistler,[1] has, however, had a different experience, for out of 170 cases of laryngeal syphilis, 88 corresponded to the secondary, and 82 to the tertiary stage.

Table A.

Showing Number of Cases of Syphilis in 10,000 *Cases of Throat-disease seen at the Hospital for Diseases of the Throat.*[2]

Pharynx	Primary—	Males	0		
		Females	1		
				1	
	Secondary—	Males	348		
		Females	143		
				491	
	Tertiary—	Males	176		
		Females	163		
				339	
	Hereditary—	Males	2		
		Females	1		
				3	
					834
Larynx	Secondary—	Males	84		
		Females	34		
				118	
	Tertiary—	Males	120		
		Females	69		
				189	
	Hereditary—	Males	1		
		Females	0		
				1	
					308
Trachea	Tertiary—	Males	2		
		Females	1		
				3	
					3
					1,145

[1] Med. Times and Gazette, Sept. 28, 1878.

[2] Although I have altogether met with seven cases of primary syphilis of the pharynx, only one was seen among the 10,000 tabulated cases.

TABLE B.

Showing Ages of Patients affected with Laryngeal Syphilis.

MALES.

Secondary.		Tertiary.
0	under 15	0
9	15 to 20	0
41	20 to 30	15
22	30 to 40	54
9	40 to 50	33
2	50 to 60	11
1	60 to 70	6
0	70 to 80	1
84		120

FEMALES.

Secondary.		Tertiary.
2	under 15	0
10	15 to 20	3
15	20 to 30	17
4	30 to 40	29
2	40 to 50	15
1	50 to 60	2
0	60 to 70	3
34		69

TABLE C.

Showing the Particular Conditions observed in Syphilis of Larynx.

SECONDARY.

	Congestion.	Condylomata.	Ulceration.	Totals.
Males	35	33	16	84
Females	16	11	7	34
	51[1]	44	23	118[2]

TERTIARY.

	Superficial Ulceration with Laryngitis.	Deep and Extensive Ulceration.	Contraction.	Gummata.	Totals.
Males	27	65	22	4	120
Females	21	42	5	1	69
	48	107	27	5	189[3]

[1] In 17 of these cases there was at the same time congestion of the trachea, and in 24 condylomata in the pharynx.

[2] In 81 of these cases there was at the same time secondary disease of the pharynx.

[3] Amongst these 189 cases, there were 7 of acute œdema, and 32 of chronic œdema.

Symptoms.—The phenomena of laryngeal syphilis vary, in different cases and in different stages, from the mildest to the most severe. Thus the patient may suffer merely from a slight inclination to clear the throat, or there may be extreme dyspnœa, advancing ultimately to such urgent suffocative attacks, as to require tracheotomy. Cough is occasionally present in the early manifestations, but rare in the later stages. The vocal function is generally impaired, and whilst at the commencement of the attack there is often only slight hoarseness, this may ultimately pass into complete aphonia. There may be no odynphagia at first, but at a later period swallowing, in some cases, becomes almost impossible. The absence of pain, when the patient is not swallowing, is very characteristic.

The pathological effects of syphilis in the larynx are extremely manifold, and comprise every kind of lesion that can be produced in the part, from a mere erythematous blush of the mucous membrane to great thickening, destructive ulceration, perichondritis, and necrosis of the laryngeal cartilages.

In *secondary syphilis*, condylomata are the most characteristic condition, but chronic hyperæmia (without mucous tubercles) and superficial ulcerations are often met with. As will be seen by reference to Table C, I met with 44 cases of condyloma among 118 patients suffering from the early symptoms of laryngeal syphilis; whilst among 88 patients in the same stage Dr. Whistler [1] saw 24 cases. On the other hand, Dr. Ferras [2] only found a single example in a hundred patients, Isambert [3] does not consider that there is such a phenomenon as laryngeal condyloma, and both Waldenburg [4] and Lewin [5] hesitate as to whether the characteristic mucous tubercles of syphilis are ever found in the larynx, being inclined to relegate the neoplasms usually described as such to the class of gummata. Again, whilst Gerhardt and Roth [6] found condylomata in 18 instances out of 56 patients suffering from constitutional syphilis, in a series of examinations at the Lock Hospital, I observed condylomata only twice among 52 patients. These wide discrepancies may perhaps be accounted for in a measure by the different periods of the year at which the observations were undertaken, some having been made in the summer and some in the winter, but they are in part to be explained by the fleeting character of laryngeal condylomata, and by the different appearance which condylomata present in the larynx as compared with the pharynx—a difference which renders them likely to be overlooked. In the larynx they generally appear as smooth yellow projections, sometimes round, but more often oval, varying in diameter from three to seven millimetres, but in rare cases attaining a breadth of a centimetre. They are seldom so white as in the pharynx, and the surrounding mucous membrane is not generally so congested. Moreover, they are less disposed to superficial ulceration, and they generally disappear quickly—even without treatment. The epiglottis and the inter-arytenoid commissure are the parts which I have most frequently found affected, but I have occasionally seen condylomata on the vocal cords.

Superficial ulcerations of limited extent are, as already remarked, occasionally met with. They generally occur from six to twelve months after the primary infection, and heal after a few weeks' treatment.

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[1] Ibid. [2] Thèse de Paris, 1872.
[3] Annales des Maladies de l'oreille, etc., t. ii. p. 239.
[4] Respiratorische Therapie, II. Aufl., 1872, p. 366.
[5] Loc. cit. p. 113.
[6] Virchow's Archiv, Bd. xxxi. 1861, Hft. 1, § 7.

In secondary syphilis, we also sometimes meet with very obstinate congestion of the laryngeal mucous membrane, but it is often impossible to tell whether this condition is really due to the syphilitic dyscrasia. I found marked congestion in 51 out of 118 cases of secondary syphilis. In every one of these 51 cases there were at the same time other well-marked symptoms of constitutional syphilis—in 24 condylomata in the pharynx. As I pointed out long ago [1] there is nothing characteristic about the congestion of syphilis, and I never consider a congestion syphilitic unless there are other well-marked evidences of the disease. Even then the laryngeal hyperæmia is often the result of accidental catarrh, and in no sense due to the syphilis. On the other hand, M. Dance [2] has gone so far as to describe roseolar, papular, and tubercular eruptions of the laryngeal mucous membrane, corresponding to similar manifestations on the skin. I have never been able to verify these observations, nor have they been confirmed by other physicians.

In *tertiary syphilis* the phenomena met with are ulceration, gummata, and cicatricial stenosis. The earliest, but not most frequent, symptom is obstinate *superficial* ulceration, accompanied by considerable hyperæmia of the mucous membrane. Dr. Whistler [3] has well described this condi-

FIG. 67.—Condyloma on the Upper Surface of the Epiglottis.

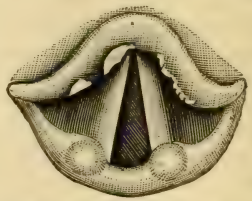

FIG. 68.—Thickening and Ulceration of the Epiglottis.

tion, under the name of "relapsing ulcerative laryngitis." When these superficial ulcers occur within a year of the primary affection, I have been in the habit of classifying them under the head of secondary syphilis, though this is a mere arbitrary distinction. But when they appear three or four years after inoculation, they may fairly be regarded as tertiary. I have met with one instance of this affection in a patient who had been successfully treated fifteen years previously at Aix-la-Chapelle. The ulceration generally attacks the vocal cords, but I have frequently seen the inter-arytenoid fold, and occasionally the ventricular bands affected.

Deep and destructive ulceration is, however, the characteristic morbid condition of the later stages of laryngeal syphilis. The ulcers may form three or four years after inoculation, but they sometimes occur twenty, thirty, forty, and even fifty years after the date of infection without the occurrence of intermediate symptoms, and when, indeed, the primary cause may have even been altogether forgotten. Their effect is to produce great loss of substance, and the consequent changes in the form of the epiglottis and other parts of the larynx are very remarkable. The ulcers may form in any region of the larynx, but the epiglottis is the part most frequently affected—one of the most common conditions consisting of general thickening of the valve, with ulceration of the central portion or lateral free edge (Fig. 68). The upper surface is more often attacked

[1] Russell Reynolds' System of Medicine, vol. iii. p. 465.
[2] Thèse de Paris, 1868.
[3] Med. Times and Gazette, 1878, Nos. 1480, 1484.

than the under surface. Under these circumstances great dysphagia is usually experienced, but when the ulcers are healed, swallowing can generally be effected without trouble, even though nearly the whole of the valve is destroyed. When the walls of the pharynx are also ulcerated, there is danger of the edges of the epiglottis uniting with them. This condition gives rise to one of the most dangerous forms of dysphagia, as well as to serious dyspnœa. The ulcerative process frequently destroys the mucous and submucous tissues to a very considerable extent, and some-

FIG. 69.—Destructive Ulceration of the Epiglottis: Irregular Hypertrophy of the Left Ventricular Band and Ary-Epiglottic Fold.

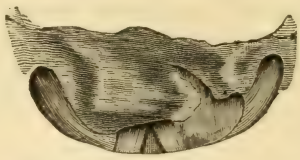

FIG. 70.—Thickening and Destructive Ulceration of Epiglottis.

times attacks the muscles, perichondrium, and cartilage. It is often associated with œdema, and is also not unfrequently followed by the formation of false excrescences, which are most apt to occur on the inter-arytenoid fold and the anterior surface of the posterior wall of the larynx, but are occasionally seen on the vocal cords.

In these advanced stages syphilitic gummata are occasionally, though very rarely, formed in the submucous tissue and muscles of the larynx. They usually appear as round, smooth elevations (Fig. 71), generally of the same color as the rest of the mucous membrane, but sometimes of a

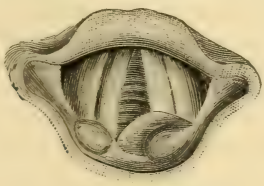

FIG. 71.—Gumma.

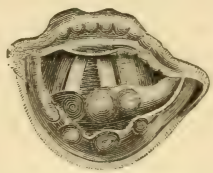

FIG. 72.—Gummata.

yellow tint. They are most frequently found on the anterior surface of the posterior wall of the larynx, and generally in groups (Fig. 72). Mandl[1] mentions the case of a negro suffering from severe pharyngeal syphilis, in whom numerous gummata, of a grayish yellow color, could be seen on the epiglottis and ventricular bands; and Norton[2] has described and figured a remarkable case, in which suffocation resulted from a gumma, the size of a pigeon's egg, in the right ary-epiglottic fold. The ulceration which results from gummata is of the deepest and most destructive kind, and often penetrates to the perichondrium.

Even when the ulcerative process is arrested, however, the danger does not cease, for the cicatrices often undergo such a degree of contraction as to greatly lessen the calibre of the larynx. Indeed, the stenosis

[1] Maladies du Larynx, Paris, 1872, p. 700.
[2] Affections of the Larynx, London, 1875, p. 86.

which so often results from tertiary ulceration is one of the greatest dangers of the disease. Sometimes the narrowing of the passage is caused by a web between the vocal cords (Fig. 73), and no less than six cases of this sequel of laryngeal syphilis have been reported by Dr. Elsberg,[1] of New York. In these cases there is generally complete aphonia. Sometimes the crico-arytenoid articulation is enlarged and the joint stiff, and thus the vocal cord may be permanently fixed in the median line, at the side of the larynx, or at some intermediate position. Sometimes the cicatricial process produces the most curious and irregular distortions and outgrowths; indeed, so much is this the case, that it is occasionally almost impossible to identify the various parts (Fig. 74).

Hereditary syphilis is occasionally met with in children, though I have never seen a case in a child younger than seven years. In each of the five examples I have met with there was ulceration of the edge of the epiglottis, with exposure of the cartilage. The only instance of the dis-

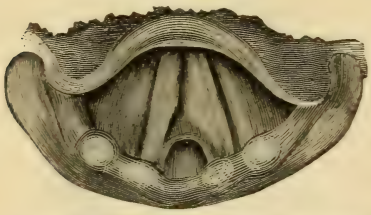

FIG. 73.—Web between Vocal Cords following Syphilitic Ulceration.

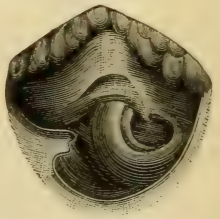

FIG. 74.—Old Cicatrices on the Epiglottis: Contraction of the Walls of the Pharynx and Horn-shaped Outgrowth on Left Side.

ease occurring in an *infant* that I am acquainted with is that observed by Isidor Frankl.[2] The subject was an infant, who was attacked with coryza two months after birth, and died from acute stenosis of the larynx in about three weeks. On post-mortem examination necrosis of the cricoid and left arytenoid cartilage was found and syphilitic disease of the liver.[3] Rauchfuss[4] mentions that, in the "Post-Mortem Records of the St. Petersburg and Moscow Foundling Hospitals," there are a few cases of deep ulceration and perichondritis in infants of from two to three months old.

Pathology.—The anatomical changes which the laryngeal structures undergo in syphilis have been investigated by Virchow,[5] who describes the phenomena with considerable detail. The general pathological features, however, have been so much touched upon in dealing with the laryngoscopic appearances that it is only necessary to make a few remarks in this place. Condylomata are the result of a hyperplasia of the epithelium of the mucous membrane, generally attended with copious cell proliferation. They show little disposition to ulceration, except of the most superficial character, and generally disappear by a process of molecular absorption. The ulcers which form so quickly in tertiary syphilis,

[1] Syphilitic Membranoid Occlusion of the Rima Glottidis, New York, 1874.

[2] Wiener Mediz. Wochenschrift, Nos. 69 and 70, 1868.

[3] A somewhat similar case is mentioned by Rollet, Dict. des Sc. Med., art. **Larynx**, p. 693.

[4] Die krankheiten des Kehlkopfes und der Luftröhre im Kindesalter, Tübingen, 1879, p. 210.

[5] Die krankhaften Geschwülste, Bd. ii. Part 2, p. 413.

result from a low form of inflammation which rapidly leads to liquefaction of tissue. Gummata are developed in the same way as in other organs, but they are very rare.

Diagnosis.—Syphilitic diseases of the larynx can generally be recognized without difficulty, either by the general features of the case or by the laryngoscopic appearances. A few cases may be doubtful at first, but simple hyperæmia is almost the only condition in which the judgment need remain long suspended. In the absence of other symptoms, it is impossible to tell whether a congestion is a simple catarrhal phenomenon, the outcome of syphilis, or the precursor of phthisis. In the early superficial ulcerations, the practitioner may likewise hesitate for a time between catarrh and syphilis, but the progress of the case soon demonstrates its nature.

The ulcers of tertiary syphilis may generally be easily distinguished from cancer and phthisis—the only affections in which error may occur through want of care.

In *syphilis* the development of the ulcer is acute, often occupying a few days only. There is generally considerable irregular swelling of a decidedly inflammatory—often œdematous—character. When the epiglottis is attacked, the upper surface is the most frequent site of the disease. Above all it should be observed that the ulcer is most frequently solitary, and hence (except in the case of the epiglottis, where it is often central) generally unilateral, and that there are scarcely ever more than two separate ulcers. These ulcers are rather deep, irregularly round or oval in shape, and commonly have a diameter of a centimetre to a centimetre and a half.

In *phthisis* the development of the ulcers is slow, generally only occurring after the throat symptoms have existed for several months. They are nearly always preceded by swelling of the mucous membrane, which is of a somewhat uniform character, partaking of the appearance of an infiltration, and extremely pale. The pallor of the mucous membrane is, indeed, a very characteristic condition. When the epiglottis is attacked it is the under surface which usually suffers; the ulcers are almost always numerous and bilateral; they are generally round and seldom more than two or three millimetres in diameter, except where the coalescence of several ulcers has produced a large breach, in which case they may attain the diameter of half a centimetre or more. In cases in which syphilis attacks phthisical patients the local symptoms are sometimes very obscure, and the diagnosis may be very difficult.

In *cancer*, the development of the ulcer is intermediate, as regards time, between syphilis and phthisis, generally occupying a few weeks. As a rule the ulcer is preceded by the development of a growth, and there are nearly always nodular excrescences upon or around the ulcer. The neighboring mucous membrane is generally acutely inflamed. The ulcers are solitary, of irregular shape, and often attain a diameter of two or three centimetres.

For further points of differential diagnosis the reader is referred to the articles on "Laryngeal Phthisis" and "Malignant Tumors of the Larynx." Lupus, lepra, and glanders all give rise to ulcerations and thickening of the laryngeal structures; but they never occur until other general symptoms have made the nature of the disease only too manifest.

Although the experienced laryngologist can at once feel sure that certain ulcers are syphilitic, yet cases occasionally occur in which it is impossible to arrive at a decision with the laryngeal mirror alone. The

diagnosis, under such circumstances, must be arrived at by attention to the history of the case, and by a consideration of the concomitant phenomena, such as the state of the pharynx, the skin, the lungs, and the general appearance of the patient. Should any doubt remain, it must soon be cleared up by watching the effects of treatment, syphilitic affections rapidly yielding, if only for a time, to appropriate treatment. As Krishaber [1] has pointed out, false excrescences resulting from syphilitic ulceration can generally be distinguished from true growths by the surrounding hyperæmia, which as a rule is altogether absent in the case of simple neoplasms.

Prognosis.—There are few cases of syphilis in which the prognosis, at least as regards life, can be said to be absolutely unfavorable. Under appropriate treatment the most destructive ulceration can generally be arrested, although frequently at the expense of a considerable loss of substance and great local deformity. Though stenosis may occur, in no class of cases are the immediate effects of tracheotomy so successful. It must be remembered, however, that where much ulceration of the vocal cords or necrosis of the cartilages has taken place, the voice must generally be looked upon as irrecoverably lost, whilst, if tracheotomy is called for, the patient will probably have to continue to wear the canula for life. The prognosis, as Krishaber [2] has pointed out, is unfavorable in proportion as the disease approaches the windpipe, and the most dangerous cases, as has been shown by Dittrich,[3] Porter,[4] and others, are those in which there is perichondritis of the cricoid and thyroid cartilages. Under these circumstances a fatal issue may ensue from acute œdema or from extensive suppuration of the surrounding soft parts. A rare instance is mentioned by Türck,[5] in which fatal hemorrhage took place from a large and deep ulcer of the left vocal cord.

Treatment.—The mode of treatment recommended under "Syphilis of the Pharynx" (pp. 69 and 70) should be pursued when the larynx is affected. But here it may be remarked that the inhalation of an atomized solution of bichloride of mercury (1 in 1,000 or 500), first recommended by Demarquay and Schnitzler, has received such strong testimony from Waldenburg [6] and Massei [7] that there can be no doubt of its remarkable efficacy in obstinate syphilitic affections of the larynx. Severe cases of œdema generally yield to the free exhibition of iodide of potassium, but if there is much dyspnœa, scarification may be required, and if, in spite of this treatment, suffocation threatens, recourse must be had to tracheotomy. When a web forms in the larynx it can sometimes be taken away with cutting-forceps, but Dr. Whistler's "cutting-dilator" (p. 194) has proved more serviceable to me in these cases. Electric cautery has been most successfully employed by Dr. Elsberg.[8] The success of any treatment, however, depends mainly on the density of the web; if it is thin no trouble is experienced, but when the membranous formation is tough and thick, the curative treatment is seldom of any avail, and I have not found

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[1] Annales des Maladies de l'Oreille, etc., September, 1878.

[2] Gaz. hebdom., Nos. 45, 46, and 47, 1878.

[3] Prager Vierteljahrschrift, Bd. xxvii. 1850.

[4] Observations on the Surgical Pathology of the Larynx and Trachea. Cases 28 and 29. Dublin.

[5] Loc. cit. p. 413.

[6] Die locale Behandlung der Krankheiten der Athmungsorgane, Berlin, 1872, pp 244 and 371.

[7] Patologia e Terapia della Laringe, Milano, 1877.

[8] Op. cit.

thyrotomy succeed where endolaryngeal methods have failed. In cases of stenosis from cicatricial contraction or disease of the cartilages, the process of dilatation described under "Perichondritis" should be pursued.

LARYNGEAL PHTHISIS.

Latin Eq.—Phthisis laryngea.
French Eq.—Phthisie laryngée.
German Eq.—Kehlkopfschwindsucht.
Italian Eq.—Laringitide tuberculosa.

Definition.—A chronic affection of the larynx attended by tumefaction and ulceration of the softer structures, and frequently by perichondritis and caries of the cartilages, arising from the local deposit of tubercle, which, as far as experience goes, is invariably preceded by a similar disease of the lungs.

History.—Petit[1] was the first physician to call attention to this disease, and his treatise, which appeared in 1790, was followed two years later by a more important work by Portal.[2] In 1802 Sauvée[3] collected these writings in a monograph which fully established the main features of the malady, but it was not till 1819 that Laennec[4] insisted on the tubercular nature of the disease. This view was disputed a few years later by Louis,[5] who, as is well known, attributed the ulceration to the corroding effect of the sputa in pulmonary phthisis. The disease was subsequently investigated by Trousseau,[6] Andral,[7] and Albers,[8] with considerable minuteness, but Hasse[9] first described the deposit of tubercles in the mucous membrane of the larynx, with anything like detail. Rheiner,[10] Rokitansky,[11] and Virchow,[12] subsequently insisted on the presence of tubercles in this part, and other observers have testified to their frequent deposit, but it remained for Heinze,[13] in his recent exhaustive monograph, to place the pathology on a thoroughly scientific basis. This elaborate work cannot be said to have been shaken by Beverley Robinson,[14] who (apparently unaware of Heinze's labors) remarks that "the elevations which have been described in the larynx under the name of miliary tubercle are none other, as a rule, than small spherical swellings, which are occasioned by the filling up with transparent fluid of the closed follicles of the submucous reticulum, which have been described by Heitler (Stricker's *Med. Jahrbücher*, vol. iii. and iv. 1874) and Coyne ('Recherches sur l'Anatomie Normale de la Muqueuse du Larynx,' Paris, 1874)."

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[1] De phthisi laryngea Dissertatio, Montpellier, 1790. We have not included a case of ulceration of the larynx described by Morgagni (De Sedibus, vol. 1, p. 10), as the lungs were not affected in this instance.
[2] Traité de la Phthisie Pulmonaire, 1792, p. 819.
[3] Recherches sur la Phthisie Laryngée, Paris, 1802.
[4] Traité de l'Auscultation, etc., Paris, 1819.
[5] Recherches sur la Phthisie, Paris, 1825.
[6] Trousseau et Belloc: Traité de la Phthisie Laryngée, Paris, 1827.
[7] Clinique Médicale, t. ii. Paris, 1829.
[8] Pathologie und Therapie der Kehlkopfskrankheiten, Leipzig, 1829.
[9] Spec. Pathol. Anatomie, Leipzig, 1841.
[10] Virchow's Archiv. Bd. v. p. 219.
[11] Lehrbuch d. pathol. Anatomie, iii., Wien, 1861.
[12] Geschwülste, ii., Berlin, 1864–65.
[13] Die Kehlkopfschwindsucht, Leipzig, 1879.
[14] Ulcerative Phthisical Laryngitis, American Journ. Med. Sciences, April, 1879.

Etiology.—The *exciting* cause is almost invariably to be found in the previous existence of pulmonary phthisis. Common experience shows that in the case of adults, at least, tubercle is rarely, if ever, found in any organ or tissue of the body, unless it has been previously deposited in the lungs, and the larynx proves no exception to this rule. It is true that it cannot be disproved that the deposit of tubercle in the laryngeal mucous membrane may not precede that in the lungs; and it is *possible* that the larynx may be the seat of the disease without the lungs ever becoming affected. All observation, however, points in the opposite direction, for in nearly every case of laryngeal phthisis, disease of the lungs can be detected with the stethoscope. Dr. Heinze remarks that during life it is difficult to determine the existence of primary tuberculosis of the larynx, because on the one hand the most careful physical examination may fail to detect small cheesy deposits or indurated spots in the lungs, especially when they are of long standing and deeply situated, and because, on the other hand, it is impossible by means of the laryngoscope to be absolutely sure that any deposit in the larynx is actually tubercular. Even when the tubercular diathesis is strongly marked, however, and when other organs are affected with tubercle, deposit is not found in the larynx unless the lungs are at the same time the seat of this disease. In 100 cases of pulmonary phthisis which I examined at the London Hospital in the second and third stages, I found laryngeal phthisis in 33 [1] cases. In 1,226 cases of pulmonary phthisis occurring at the Pathological Institute of Leipzig between the years 1867 and 1876, there was, according to Heinze, laryngeal ulceration in 376 cases, or 30.6 per cent.

The *predisposing* circumstances are sex and age, men being much more frequently affected than women, and the vigorous period of adolescence—twenty to forty—being the time of life at which the disease is most common, the greatest number of cases, however, occurring between twenty and thirty. In 500 cases of marked laryngeal phthisis which I examined during life there were 365 males and 135 females, or 2.70 males to one female, and in 100 autopsies I found the same ratio, the proportion being 73 males to 27 females. From an analysis of 70 cases, Dr. Marcet [2] states that twice as many men as women are affected. Dr. Heinze gives the proportion of males to females as 33.6 to 21.6. The following tables illustrate some of the points referred to.

TABLE A.

Sex and age in 500 cases of Laryngeal Phthisis examined during Life by the Author.

MALES.		FEMALES.	
Ages.		Ages.	
15 to 20	13	Under 15	1
20 to 30	149	15 to 20	21
30 to 40	115	20 to 30	45
40 to 50	61	30 to 40	47
50 to 60	27	40 to 50	21
		50 to 60	0

[1] In these 100 cases of pulmonary phthisis the laryngeal mucous membrane was normal twenty-nine times, anæmic five times, congested twenty-seven times, superficially ulcerated five times, aphthous once, infiltrated twenty times, infiltrated and ulcerated thirteen times.

[2] Lancet, February 27, 1875.

TABLE B.[1]

One Hundred Autopsies in Cases of Laryngeal Phthisis by the Author.

MALES.		FEMALES.	
Ages.		Ages.	
5 to 10	1	5 to 10	0
10 to 15	3	10 to 15	1
15 to 20	11	15 to 20	5
20 to 30	31	20 to 30	11
30 to 40	23	30 to 40	8
40 to 50	3	40 to 50	2
50 to 60	1	50 to 60	0

TABLE C.

Cases occurring in the Pathological Institute of Leipzig, from 1867 *to* 1876.

	Pulmonary Phthisis.	Laryngeal Ulceration.
Under 1 year	13	1
1 to 10	39	4
11 to 20	92	23
21 to 30	406	130
31 to 40	303	112
41 to 50	179	67
51 to 60	104	27
61 to 70	53	9
— to 70	25	3
Of unknown age	12	

Although my statistics only include one case of laryngeal phthisis under ten years of age, and Heinze's only four, I have met, in addition to these, with three cases of children between five and ten years of age, and four between ten and fifteen, and Rheiner [2] has reported a case at four years.

Pursuing the etiology somewhat further, the subject is beset with great difficulties, and it has not yet been determined what is the cause of the secondary deposits in the larynx. Louis,[3] whilst maintaining that ulceration, when present, was caused by the destructive action of the pulmonary sputa, nevertheless admitted that the ulceration bore no relation to the irritating quality of the expectoration, and that there were many cases of extensive destruction of the lungs, and old tubercular cavities without any laryngeal ulceration. It has been pointed out by other physicians that the laryngeal ulceration occurs in some cases before any cavities are formed, and also in some cases in which there is scarcely any expectoration. It has been urged that ulceration of the larynx is not generally present in cases of gangrene of the lung, where the pus is probably

[1] None of the cases contained in Table A are included in Table B.
[2] Loc. cit. [3] Op. cit.

of a more irritating nature, but it must not be forgotten that gangrene is more likely to occur in the non-scrofulous than otherwise, and, hence, this argument falls to the ground. Further, the fact that the ulcerations in the larynx are scattered is opposed to the theory that the disease could be caused by the expectorated mucus which comes in contact with all parts of the larynx. That the disease originates from the corrosive action of the sputa is, moreover, rendered improbable by the pathological investigations of Heinze, who shows (see Pathology) that the destructive process commences from within, not from without. Rheiner's[1] theory that the ulceration is caused by friction has also been disposed of by Heinze, who has pointed out that the catarrhal inflammation, which almost invariably precedes ulceration, prevents the vocal cords coming together, and that the vocal processes which are stated by Rheiner to be a frequent site of the disease do not actually come in contact with one another. It may be added that the under-surface and base of the epiglottis, which are comparatively free from attrition, are more frequently attacked by tubercular ulceration than the edges which are much exposed to friction. Some physicians suppose that the constant hacking cough, which is a characteristic symptom of tubercular disease of the lungs, causes the morbid process to be developed in the larynx.[2] It is only, however, from a theoretical standpoint that this cause can be upheld as being concerned in the production of laryngeal phthisis.

In some cases, secondary tubercle is developed in the intestines, in others in the larynx; sometimes the kidneys, sometimes the spleen are the parts secondarily implicated; but the reason why tubercle in any given case shows a greater preference for one organ than for another is probably due to weakness on the part of the organ attacked. The weakness of the larynx may either be congenital, or it may be acquired, owing to that organ having been frequently attacked by inflammatory affections of a more or less pronounced character. Thus, a great many patients suffering from laryngeal phthisis date the commencement of their illness from a severe catarrh. A chronic weakness of the vocal organ may also be developed by persistent overexertion of the voice, as in the case of public speakers, singers, auctioneers, military and naval officers, etc. Under these circumstances some special laryngeal affection is ultimately induced, which, if tuberculosis be present in the system, is very likely to culminate in the local phenomena of laryngeal phthisis. Dr. Marcet[3] did not, however, find the excessive use of the voice a frequent cause of the disease in his seventy cases, but attributed its occurrence rather to sedentary in-door occupations, which I have shown (see Catarrhal Laryngitis) to be a frequent predisposing cause of subacute inflammation of the larynx.

In returning to the subject of the possible primary deposit of tubercle in the laryngeal mucous membrane, I must again refer to Dr. Heinze's valuable labors. In addition to collecting and analyzing the records of the Leipzig Pathological Institute for many years, this pathologist, during the year 1876, made most minute pathological investigations upon 50 bodies of persons who had died of pulmonary phthisis. In 47 of these there was tubercular ulceration of the larynx or trachea, and in no instance did it appear that the deposit in the larynx or trachea had preceded the pulmonary deposit. "No case of primary laryngeal phthisis," he

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[1] Loc. cit.
[2] Dict. des Sc. Méd., Paris, 1868. Article Larynx, by Krishaber and Peter, p. 666.
[3] Loc. cit.

observes, "has ever been published in which post-mortem examination has shown that there was true tubercular ulceration of the larynx as a primary affection whilst the lungs were intact." He further remarks, "that it is *possible* that tubercle may first be deposited in the larynx, and afterward in the lungs, but this is difficult to establish, as cases of simple laryngeal phthisis would only come under observation through some intercurrent acute affection of some other organ than the lungs, or from some fatal accident. As a rule, on post-mortem examination, the lung affection is much more advanced and of much older date than the laryngeal disease." I formerly published some fatal cases which I believed were examples of laryngeal phthisis, in which the lungs were healthy, but I must freely admit that I formed my opinion from naked-eye appearances, not from histological examination.

Symptoms.—At the commencement there is nothing characteristic about the symptoms of this malady. The usual phenomena of chronic laryngitis are present, but the laryngeal symptoms are to some extent masked by those dependent on the pulmonary condition. The following table shows the proportionate frequency of some of the symptoms :

TABLE D.

Symptoms in 500 *Cases of Laryngeal Phthisis examined during Life.*[1]

Aphonia	123
Dysphonia	337
Dysphagia	151
Sore throat	62
Stridulous breathing	8
Great dyspnœa requiring tracheotomy	3
Cough	427
Shortness of breath on slight exertion	415

Hoarseness is generally present in the early stages, aphonia when the disease is advanced, but sometimes there is functional aphonia from the very first.[2] It will be seen from the printed table above that the vocal function was more or less impaired in 460 out 500 cases, *i. e.*, in 92 per cent. In 100 cases of pulmonary phthisis examined at the London Hospital, in which there was no laryngeal phthisis, there was hoarseness, either constant or occasional, in 37 cases. In 1 of these there was paralysis of the right recurrent nerve, in 4 the aphonia was due to imperfect tension, or insufficient adduction of the vocal cords, whilst in the remainder the cause of the impaired function was slight congestion of the vocal cords.

Dysphagia occurred in nearly a third of my cases, *i. e.*, in 30.2 per

[1] The notes of nearly 200 of these cases were taken from me in 1873 and 1874 by Dr. Porter, of St. Louis, at that time acting as one of my clinical assistants. This physician has since written some excellent practical directions (hereinafter referred to) as regards the treatment of laryngeal phthisis.

[2] In the year 1865 I examined a number of cases of pulmonary phthisis, in which the voice was affected, at the Brompton Hospital, and found the impairment of function to be neurotic (due to loss of power of the adductors or tensors) in nearly one-third. Hoarseness and Loss of Voice in Relation to Nervo-muscular Affections of the Larynx, 2d edition, 1878, page 3.

cent. This symptom does not occur so frequently in any other chronic disease of the throat. The difficulty of swallowing is of three kinds. In the early stage it generally partakes of the character of *odynphagia*, being due to pain in swallowing. Later on there is often obstruction from the enlarged epiglottis and the swollen ary-epiglottic folds; whilst at a still more advanced period the difficulty of swallowing is due to the imperfect closure of the larynx, and the consequent passage into that tube of the ingesta.

Sore throat, that is to say, a feeling of soreness occurring independently of deglutition, was present in 12.4 per cent. of my cases.

Cough was a marked symptom in 427 of my 500 cases. Though nearly always present to a greater or lesser extent, it is not generally a prominent symptom in the early stage. It may be very slight and occasional, or it may be frequent and irritating—what is called "a tickling cough." In the later stages of the disease, however, there are often violent paroxysms of the most prolonged and exhaustive character.

Shortness of breath occurred in 415 of my 500 cases. This symptom is partly due to the disorganized condition of the lungs, and partly to the inability to close the glottis. The latter condition has been described by Ziemssen[1] as phonative loss of breath. *Laryngeal dyspnœa* occurred in 2.2 per cent., necessitating tracheotomy in .6 per cent.

Expectoration varies both in quantity and quality, and, in fact, depends more on the condition of the bronchial tubes and lungs than on that of the larynx.

Some of the *other phenomena* which accompany laryngeal phthisis are characteristic, the cachectic look of the patient being often very marked, even at the beginning of the disease. On *laryngoscopic examination*, the appearance of the organ is seen to vary considerably at different periods in the course of the malady, but generally has some special features by which its true nature may be recognized. In cases of pulmonary phthisis pallor of the mucous membrane is often noticed, and Dr. Semeleder first called attention to anæmia of the larynx as a frequent pretubercular condition of that organ. This view has since been maintained by Sawyer,[2] Solis Cohen,[3] Semon,[4] and others, and it is probable that feeble local nutrition predisposes to the deposit of tubercle. The existence of marked anæmia of the larynx should always induce the practitioner to make a careful examination of the apices of the lungs. It must not be forgotten, however, that in all anæmic and chlorotic states of the system the laryngeal mucous membrane participates, and it is only in the non-existence of other conditions that tubercle must be suspected. In any case, however, the anæmia often gives way to congestion—a congestion which is by no means characteristic or distinguishable from chronic catarrh. On the other hand, when the deposit of tubercle has taken place to some considerable extent, the appearance is often pathognomonic. The ary-epiglottic folds look like two large, solid, pale pyriform tumors, the large ends being against each other in the middle line, and the small ones directed upward and outward. The surface is, as already remarked, generally pale, but there may be accidental congestion. The inter-arytenoid fold is lost in these swellings, which interfere with the action of the arytenoid cartilages, and thus prevent approximation of the vocal cords. It must not be expected that this peculiar swelling of the

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[1] Loc. cit.
[2] Lancet, January 30, 1875.
[3] New York Med. Record, No. 26, 1878.
[4] London Med. Record, April 15, 1879.

ary-epiglottic folds will be found in every instance; but it will be met with in by far the greater number of cases, and when present is typical of laryngeal phthisis. The epiglottis may be thickened, but sometimes shows no signs of deposit. Such are the appearances which are typical of the first stage of laryngeal phthisis. In the second stage ulceration takes place, and the ulcers are almost always small and scattered. It will be observed that I only recognize two stages in laryngeal phthisis, viz.,

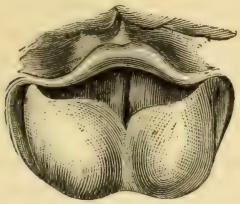

FIG. 75.—Laryngeal Phthisis, showing the pyriform swelling of the ary-epiglottic folds.

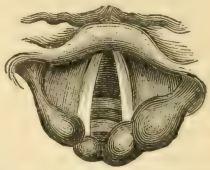

FIG. 76.—Incipient Laryngeal Phthisis involving the left ary-epiglottic fold, but before the true pyriform swelling is developed.

the first stage in which deposit takes place, and the second stage, in which ulceration occurs. It will, perhaps, simplify matters if the morbid changes in the separated parts are now described in detail.

Ary-epiglottic Folds.—Sometimes the ary-epiglottic fold of one side is alone affected (as in Fig. 77), and at an early stage the projection of the cartilages of Wrisberg and Santorini interferes with the distinctly pyri-

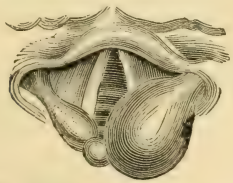

FIG. 77.—The same case more developed, showing one ary-epiglottic fold of the pyriform shape (as far as the woodcut is concerned the drawing might answer as well for œdema, as the density of the swelling cannot be shown).

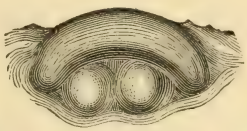

FIG. 78.—Laryngeal Phthisis, showing the turban-like thickening of the epiglottis and the swollen mucous membrane over the arytenoid cartilages.

form shape of the tumors (Fig. 76), but when fully formed they are very characteristic of the disease. As the affection progresses, a certain amount of œdema is almost always superadded to the more solid deposit.

Epiglottis.—The epiglottis is not unfrequently thickened and ulcerated, and sometimes it is so much enlarged as to prevent an inspection of the parts below. In other cases, the valve assumes an altered position and covers the opening of the larynx, a phenomenon which, as Dr. Krishaber [1] has pointed out, is often met with at quite an early period of the disease; at a more advanced stage its shape is often somewhat turban-like (Fig. 78), the normal contour and surface marks having completely disappeared. In addition to the thickening, the epiglottis is, in fact, often rolled backward on itself, so that the free edges cannot be seen in

[1] Loc. cit. p. 650.

the laryngeal mirror. In other cases where they are visible, the cartilage is exposed from ulceration (Fig. 80). Sometimes there is general thickening, with scattered points of ulceration (Figs. 79 and 80). The presence of a great number of small, scattered, and obstinate ulcers is indeed very characteristic of the disease.

Ventricular Bands.—Thickening and ulceration of the posterior part of the ventricular bands can sometimes be seen, but the disease may make considerable progress in this site without coming into the field of vision. By placing the mirror somewhat obliquely, and slightly twisting the patient's neck, ulcers in this situation can, however, be detected.

Vocal Cords.—Slight thickening of the vocal cords is an early phenomenon, and ulceration is very frequent, the most common position being at the *processus vocalis.* The elastic tissue is often exposed, and not unfrequently eroded.

In the most advanced stages of laryngeal phthisis, the ulcerative process often makes such ravages that the larynx becomes almost denuded of mucous membrane, whilst the greater part of the epiglottis is eaten

FIG. 79.—Laryngeal Phthisis, showing great thickening, with scattered ulcers.

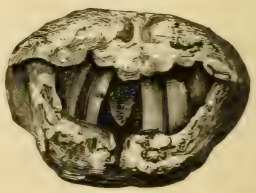

FIG. 80.—Laryngeal Phthisis, showing destruction of a large portion of the epiglottis, and general ulceration.

away. At the same time perichondritis and destruction of the cartilages often occur. In the absence of the physical signs of pulmonary phthisis, it is not always possible to tell whether a case of laryngeal ulceration is tubercular or not, especially in the absence of marked infiltration. Though Ter Maten [1] and Türck have described the *laryngoscopic appearances of tubercle,* Heinze very properly declines to accept these observations, remarking that even in the case of a larynx fresh from the body, it is impossible to determine absolutely with the naked eye whether the ulceration is tubercular or not, although the matter can be easily settled with the microscope. Paralysis of one of the vocal cords is sometimes present, the right recurrent nerve being occasionally pressed on when the apex of the right lung is diseased (*see* Paralysis of the Recurrent Nerves), and the left being sometimes impinged on by an enlarged gland. These, however, are rare phenomena. More often the immobility of one of the cords is of a purely mechanical character, due to general infiltration of the tissues.

Pathology.—Secondary tubercular deposit in the larynx is a very common sequel to pulmonary phthisis. According to Heinze, the larynx is next most frequently affected after the intestines, but Williğk's statistics place the mesenteric glands as well as the intestines above the larynx. In Heinze's 1,226 cases of pulmonary phthisis, tuberculosis occurred in the following descending scale: In the intestines, in 630 cases; in the

[1] Nederlandsch Tijdschrift voor Geneeskunde, Treede Afdeelig, 1865, p. 36.

larynx, in 376;[1] liver, 286; kidneys, 150; pleuræ, 137; spleen, 120; glands, 106; trachea, 99; peritoneum, 95; membranes of the brain, 43; sexual organs, 21; omentum, 21; tongue, 18; bronchi, 15; pharynx, 14; vesical organs, 12; brain, 12; pericardium, 11; tonsils, 8; mesenteric glands, 7; œsophagus, endocardium, supra-renal capsules, each 5; knee-joint, thyroid glands, outer coat of aorta, muscular substances of heart, of each 1. According to the statistics of Williqk,[2] made in the Prague Pathologico-Anatomical Institution, out of 1,317 cases of tuberculosis, there were 656 of the intestines, 237 of the mesenteric glands, 182 of the larynx, and 242 of other organs. The difference in these two sets of statistics is probably to be accounted for by the more careful microscopic examinations of Heinze.

The laryngoscopic appearances of laryngeal phthisis have already been described, but the broad features of the pathology must again be pointed out before the minute changes are detailed. Structural changes are often preceded by obstinate hyperæmia, which cannot be distinguished from chronic catarrhal laryngitis.

Thickening of the tissues constitutes, when due to the deposit of tubercle, the true first stage (that of deposit), the amount of thickening varying in different situations, but the ary-epiglottic folds and epiglottis being more frequently infiltrated and swollen to a greater extent than any other parts; in the second stage small ulcers form, which afterward coalesce and produce larger ulcers (the secondary tubercular ulcers of Rokitansky). Chronic œdema almost always accompanies or follows the tubercular deposit. In 500 cases of laryngeal phthisis which I examined during life, there was evidence of œdema 165 times. In many of these cases the observation was made in an early stage of the malady, and no doubt the tendency to œdema increases as the disease advances. Thus in 100 autopsies of laryngeal phthisis, œdema—circumscribed or general—was present in 71 instances. The following table shows the results, as regards thickening and ulceration, in the different parts of the larynx:

TABLE E.

Pathological Results in 500 *Cases examined during Life.*

	Epiglottis.	Arytenoid Cartilage or Ary-epiglottic Fold.	Vocal Cords.	Vent. Band.	Inter-arytenoid Folds.
Thickening...	175	397	173	113	101
Ulceration....	111	52	157	97	92

Thickening, either general or circumscribed, was present in every case; thickening with ulceration in 193 cases. In my 100 cases examined after death, however, I found ulceration in 97 cases, as will be seen from the annexed table:

[1] This is the number of cases of ulceration of the larynx; about fifty of these, or 14 per cent., were probably non-tubercular.

[2] Prager Vierteljahrschrift, ii., 1856.

TABLE F.

Post-mortem (*Naked Eye*) *Appearances of Mucous Membrane in* 100 *Cases.*

	Epiglottis.	Arytenoid Cartilage or Ary-epiglottic Fold.	Vocal Cords.	Vent. Band.	Inter-arytenoid Folds.
Thickening ...	81	97	81	95	93
Ulceration....	69	78	89	91	91

There was also necrosis, with separation of perichondrium by pus, in 15 cases; perichondritis (thickening of perichondrium) in 11 cases, without apparent separation of perichondrium; and ossification of cartilages in 79 cases.

Tubercular *infiltration*, according to Heinze, is present in about half the cases of laryngeal phthisis, but it has appeared to me to occur much more frequently. The deposit can often be recognized macroscopically as a smooth, elastic, yielding swelling of grayish white or grayish yellow color, which on its surface frequently shows a whitish yellow deposit, either collected in little masses or confluent. Microscopically the appearance is very characteristic. There is general thickening of the diameter of the mucous membrane (equally affecting both the mucosa and submucosa), so that it becomes from three to four times its ordinary thickness. This is most conspicuous in the covering of the arytenoid cartilages, in the ary-epiglottic folds, and in the epiglottis. As regards the epithelium, until ulceration has actually taken place there is no great change, even when there is considerable deposit of tubercle beneath the epithelial structures—a circumstance which is opposed to the view that tubercular infiltration is due to the corrosive action of the sputa. The deposit consists of *tubercles*, which are made up of more or less circumscribed collections of cells of various shapes and sizes, having a somewhat concentric arrangement upon a scaffold of lymphoid reticulum. The tubercles, some very small, and some as large as a millet-seed, have frequently, in their centre, a "giant cell," around which are lymphoid cells, and some few larger cells with nuclei of high refracting power. The tubercular deposit is found both in the mucosa and in the submucosa, but always above the layer containing the mucous glands. It is sometimes deposited uniformly through the thickness of the mucous membrane, but is much more commonly found in the most superficial layer of the mucosa, immediately beneath the epithelium. In the deeper layers of the mucosa both the tubercles and the round cells are less abundant. Occasionally we meet with deposits of tubercle near the epithelium, whilst the tissue between the deposit and the epithelium contains a few round cells and many capillary vessels, but no tubercle—a circumstance which further tends to show that the tubercular ulcer originates through perforation from *within*, not from without. The tubercle is of different date: sometimes it shows fatty degeneration at its centre, sometimes such complete caseation that only its walls remain.

In describing the microscopical appearances I have made large use of the valuable work of Heinze already referred to. Until the publication of his essay I had not given my attention to the minute histology of this important disease, but since then my brother, Dr. Stephen Mackenzie, has made careful microscopical examinations of my recent pathological speci-

mens, and has furnished me with the following report, which, it will be seen, fully confirms Heinze's observations:

"In the specimens submitted to me, the epithelium presents no important alterations. The mucosa and submucosa are greatly swollen and œdematous, and infiltrated throughout with lymphoid cells, which occur both as a general infiltration and in more or less circumscribed collections with a somewhat concentric arrangement. These collections are supported by a delicate reticulum, and their centres are often pale and necrotic. The circumscribed collections of lymphoid cells frequently enclose two, three, or more large plates or spheres of protoplasm containing a great number of vesicular nuclei and delicate peripheral filamentous processes (giant cells). The appearances are, indeed, similar to that which is seen in tubercular diseases wherever occurring. In the laryngeal mucous membrane there appears to be a general infiltration (such as is commonly observed in chronic inflammation), associated with more or less well-defined and often coalescing tubercles. As regards the position of the latter, they occasionally appear to be placed laterally to arteries, but this may be only accidental, the irregular course of the vessels in the laryngeal mucous membrane not being favorable to tracing any relationship. Sometimes they are close to the dilated ducts of the mucous glands, which show some alterations. In parts both acini and ducts are dilated, and whilst containing small round cells, they are surrounded by a considerable amount of cellular infiltration. The tubercles occur at all depths from close beneath the epithelium to near the cartilages. None are free on the surface, except where it is ulcerated.

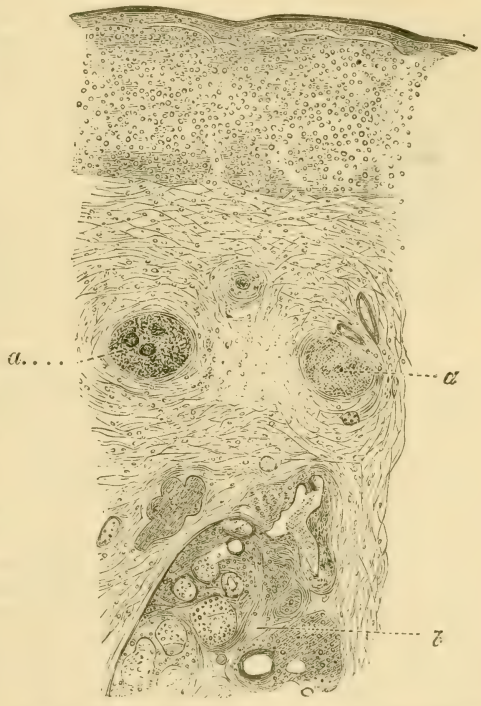

FIG. 81.—Section through the Right Ary-epiglottic Fold, showing Tubercles in Sub-mucosa: *a*, Tubercles; *b*, Mucous Glands.

The *cartilaginous* framework of the larynx shows the effects of tuberculosis in various ways. Perichondritis is characterized by the abundance of pus-cells between the bands of the perichondrium. The suppuration is sometimes so active that the whole structure may disappear, and the cartilage lie loose in an abscess. The intercellular substance of the hyaline cartilages first becomes opaque, and afterward shows signs of fatty degeneration, whilst the elastic fibres of the epiglottis become infiltrated with pus, and the cartilage cells disappear by fatty degeneration. According to Heinze, perichondritis only occurs when the tubercular process approaches the cartilages or reaches the perichondrium, neither perichondri-

tis nor chondritis being ever met with in cases of catarrhal ulceration of the larynx. I feel convinced, however, that this view is incorrect, and that perichondritis occasionally supervenes in cases of long-standing but simple chronic laryngitis. Heinze maintains that the largest swellings met with in laryngeal phthisis are not due to perichondritis, but to tuberculosis of the mucous membrane, and that in cases of perichondritis the tumefaction is often very slight.

Ulceration is the common sequel of the deposit of tubercle in the mucous membrane of the larynx. Friedrich has stated that the larynx is most frequently affected on the same side as the lungs, but I have not found this to be the case. On this subject Heinze remarks that during life it is impossible to be certain that the apparently sound lung is intact; and further, that on post-mortem examination it is rare to find the ulceration entirely confined to one side. In fifty cases of pulmonary phthisis in which there was laryngeal ulceration, he observed *tubercular ulceration* of the larynx in forty cases, non-tubercular ulceration of the larynx (but tubercular ulceration of the trachea) in seven, and three in which there was no tuberculosis. Tubercular ulceration is characterized by the presence of tubercles in the edges or bases of the ulcers, but ulcers must also be regarded as tubercular, even though no characteristic tubercle is present, when giant-cells are found (either alone or associated with round cells) diffusely infiltrated in a reticular structure.

FIG. 82.—Portion of one of Tubercles in preceding Fig. more highly magnified to show Giant Cells.

A few words are required as regards the special tissues of the larynx. Sometimes the tubercular process commences in the *glandulæ*, the deposit of round cells, in the interstices between the acini gradually encroaching on the membrana propria, and leading to the destruction of the acinous structure, so that a capsule which in a state of health would contain twenty or thirty acini is found holding only four or five of these bodies. At last the capsule is destroyed, and there only remain isolated portions of degenerate gland structure. The ducts of the glands have the greatest power of resistance, and are often found in the tubercular infiltration intact with perfect cylindrical epithelium. Tubercular ulcers commencing in the glands have been carefully described by Rindfleisch,[1] who observes that they begin at the mouths of the mucous glands, and in appearance are circular, and flat or funnel shaped, with narrow but extremely yellow borders. On section of the *arteries*, a mass of round cells is often found partly outside the adventitia, but for the most part amidst its fibres. Sometimes there is an abundance of tubercles, some recent and some of old date, showing signs of caseation. In these cases the adventitia is generally destroyed, whilst the muscularis and intima of the arteries almost always remain intact. The muscularis of the *veins* is, however, much more easily destroyed, and the lumen of the vessels un-

[1] Lehrb. d. Path. Gewebelehre, iv. Aufl., 1875, p. 325.

dergoes great modification and contractions. The *capillaries* show the same power of resistance as the arteries, their endothelial cells generally remaining unchanged, and their walls of normal strength. The capillaries are often found in excess between the tubercular deposit and the lower layer of the superjacent epithelial cells. Tubercle is very seldom detected within the *muscular structures*, but Fränkel[1] found the contractile substance, the perimysium internum and corpuscles in a state of fatty degeneration. He states that the muscle-corpuscles were increased either in number or size in all the muscles he examined. Heinze rarely met with changes in the muscular structure, but in two cases tubercles were present. Once a small fresh tubercle was found between the fasciculi, and once the deposit was in such abundance that only the section of two or three separated fibres remained in the midst of the tubercle. In a few cases Heinze found the muscle-corpuscles increased in number. It may be stated that these changes in the structure of the muscles are the results of chronic nutritive deviations, and not specially characteristic of the tubercular process.

Diagnosis.—Where the characteristic semi-solid pyriform swellings of the ary-epiglottic folds are present it is almost impossible to mistake the disease ; but where the thickening is not of such a defined character the diagnosis is not quite clear. The examination of the lungs will sometimes confirm a doubtful diagnosis, and where auscultation yields negative results, a careful search should be made in the sputa for the elastic tissue of the lung.

The conditions which are most likely to give rise to an error are chronic laryngitis, chronic œdema, and syphilitic thickening or ulceration. In chronic laryngitis the swelling is generally much less than in laryngeal phthisis, whilst there is more hyperæmia ; in œdema the much greater transparency of the swelling differentiates it from phthisis, though it must be admitted that in advanced laryngeal phthisis œdema is usually added to the tubercular infiltration.

In syphilis the thickening is very irregular, and the ulcers are generally large and solitary, and hence frequently unilateral ; they are also commonly surrounded by an inflamed areola. In phthisis, on the other hand, the swelling is more smooth and uniform, whilst the ulcers are small, numerous, scattered, and situated on a pale ground. The two diseases differ also as to the parts they attack. Thus, when syphilis assails the epiglottis, it is the lingual surface and free edge which generally suffer ; whilst in tubercular ulceration, though the free edge of the epiglottis is often attacked, it is the under surface and base which are more generally and more deeply affected. In both diseases the whole valve may be eaten away, but this result is seen far more often in syphilis than in phthisis. Ulceration over the arytenoid cartilages is comparatively rare in syphilis, but very common in tuberculosis, and the same observation is applicable to the ventricular bands and the anterior commissure of the vocal cords. Both diseases attack the vocal cords very frequently, but while phthisis generally affects both vocal cords, in syphilis one cord alone is not uncommonly ulcerated.

The ulcerations in laryngeal phthisis may be extensive, but the actual loss of substance which takes place is not generally so great as in tertiary

[1] Ueber pathol. Veränderungen d. Kehlkopfmusculatur bei Phthisikern, Virchow's Archiv, 71–73, 1877.

syphilis. For further observations on differential diagnosis, the reader is referred to the article on Syphilis, page 263.

Catarrhal ulcerations are nearly always very superficial, so that they have more the character of erosions, and are most common on the vocal cords. Non-tubercular ulceration may, of course, supervene in a person suffering from pulmonary phthisis, and such ulcerations may afterward become tubercular through the deposit of tubercles.

Prognosis.—The prognosis of laryngeal phthisis is always extremely unfavorable, and it is not certain that any cases ever recover. Of all the cases of laryngeal phthisis that I have ever seen, I only know of four in which I have reason to believe that the disease was entirely arrested. In these instances—in all of which there was deposit in the lungs, and in one a cavity—the laryngeal signs of the disease disappeared, whilst those appertaining to the lungs remained stationary and retrograded. In considering the probable duration of life, the age and family history of the patient, the character and stage of the lung disease, the amount and kind of expectoration, the frequency of the pulse, the temperature of the body, the rate at which loss of weight takes place, are the main criteria. These various matters are discussed in detail in the text-books of medicine, and in monographs on phthisis, and it need only be remarked here that, as a rule, patients from eighteen to twenty-five years of age succumb most quickly, and that where there is a strong family predisposition to tuberculosis the fatal issue is sooner reached. Disease *within* the larynx is less rapidly fatal than when the morbid process attacks its *outer* portions; in other words, if the epiglottis, or ary-epiglottic folds are infiltrated or ulcerated the disease terminates more quickly than when the ventricular bands or vocal cords are the seat of the disease. This is accounted for by the fact that ulceration of the more exposed portions of the larynx interferes most with the act of deglutition, and hence favors marasmus. *Cæteris paribus*, the greater the amount of infiltration the more unfavorable the prognosis; and in cases in which there are numerous scattered ulcers, without much thickening of the mucous membrane, the progress is slower than where there is general infiltration.

The following is the duration of life (in months) after the throat-symptoms had begun to be troublesome in 100 cases subjected to post-mortem examination. It will be seen that in the greatest number of cases death occurred in from twelve to eighteen months, and that 66 per cent. occurred between six months and two years. Further, it is to be observed that very few patients lived more than two years and a half, and very few died before six months:

Table G.

Duration of Life after Throat-symptoms had become Troublesome.

No. of Cases.	Duration of Life in Months.	No. of Cases.	Duration of Life in Months.
1	49	19	18 to 24
2	42 to 48	30	12 to 18
4	36 to 42	17	6 to 12
5	30 to 36	4	3 to 6
13	24 to 30	5	under 3

Treatment.—The constitutional treatment must be the same as that commonly employed in tubercular disease of the lungs. As regards local

remedies, the plan already recommended for chronic laryngitis sometimes gives relief—the application of mineral astringents, by diminishing the irritability of the mucous membrane, often quieting the cough. Of these I have found perchloride of iron (℥ j. ad ℥ j.) the most serviceable. In the early stages, Dr. Porter [1] has observed excellent results from local applications of a solution of sulphate of iron and ammonia. In some cases soothing inhalations of benzoin or hop act very beneficially. When the cough, however, becomes very troublesome, no treatment gives so much relief as the insufflation of morphia. One-eighth of a grain diluted with starch should be blown down twice a day, and as the disease advances the dose should be increased to one-fourth or one-half a grain. It is important to get the larynx, as far as possible, cleared of the masses of mucus which often cover it, before the powder is introduced; and the patient should endeavor not to cough for a few minutes after the application has been made. This treatment relieves the cough, and generally removes the distressing odynphagia, which, by preventing the patient taking a proper amount of food, hurries on the fatal issue. The fact that the maximum local anæsthesia is obtained in rather less than an hour furnishes the indication for the time of administration of the powder in reference to taking food. When there is much œdema, scarification affords relief. These are the simple measures which, after trying many plans of treatment, I have been induced to adopt. Other physicians, however, have recommended various procedures, some of which may be here referred to. Thus Dr. Schnitzler [2] advises insufflation of nitrate of silver, or acetate of lead diluted with sugar of milk ; whilst Dr. Marcet [3] recommends, as a local application, a solution of iodine in olive oil—twenty grains of iodine with five grains of iodide of potassium in an ounce of oil, and further advises that this iodized oil should be rubbed into the skin of the neck over the larynx. Dr. Marcet also advises scarification "in the swollen and indurated form of laryngeal phthisis." Believing that the tubercular process originates in a high state of local vascularity, which is "followed by an abnormal function residing in the tissue and exerted upon the blood," he considers "that by the puncture of the inflamed part, and the consequent relief of the vessels, fresh blood is admitted into the capillaries, and the normal vital force of the tissue is again called into action." In this way he supposes that the morbid process may be temporarily arrested ; though, of course, the primary deposit may continue as a cause of irritation and inflammation. When, however, the mucous membrane is *extensively* infiltrated with tubercular deposit, Dr. Marcet thinks that scarification should be withheld. Dr. Krishaber [4] considers that cauterization with Vienna paste of the outside of the neck just over the thyroid cartilages, has often been productive of the best results. He directs that the wound should be kept in a state of suppuration for one or more months.

Where the patient can swallow to a slight extent, but experiences difficulty from food occasionally entering the larynx, he should be directed to take thickened liquids. A little arrowroot, corn flour, or isinglass, may be used for giving a proper consistence to the fluids. By thickening the drink it will be much less likely to pass beneath the edges of the epiglottis into the larynx. It is also well to direct the patient to take the drink

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[1] Tubercular Laryngitis, Trans. Missouri State Med. Assn., 1878.
[2] Ueber Kehlkopfgeschwüre, Wien. Med. Presse, No. 14, u. f. 1868.
[3] Clinical Notes on Diseases of the Larynx, London, 1869, pp. 94 and 135.
[4] Loc. cit. p. 673.

at a draught—not to sip it. This mode of procedure makes the act of deglutition continuous, instead of intermittent, and under these circumstances the passage of food into the larynx is much less likely to occur. When the patient is unable to swallow at all, life may be often prolonged by feeding him with the œsophageal tube. As already pointed out, the dysphagia at this stage of the disease is generally due to the act of deglutition being imperfectly performed from non-closure of the larynx by the epiglottis, not to obstruction in the food-tract caused by the thickened epiglottis and arytenoid cartilages. It is from food "going the wrong way," not from the fact of its being prevented passing down the gullet, that the difficulty in swallowing arises. Hence there is generally very little difficulty in introducing the œsophageal tube. (See Œsophageal Instruments.) The fatal termination of phthisis is, of course, much accelerated if the supply of food is to a great extent cut off, and I may observe that I have prolonged life for many weeks by giving food and stimulants in the way described. Alcoholic liquids, which the irritability of the throat would not allow to pass, can be readily introduced into the system by this method. Nutritive enemata can be employed instead of the œsophageal tube, but the results of this method are less satisfactory.

If there is much dyspnœa tracheotomy should be performed, but the effect of the operation is, as a rule, only to prolong a miserable existence. I cannot recommend the operation as in any sense curative, and quite agree with Dr. Solis Cohen, who remarks[1] that "it cannot be curative, either directly or indirectly, and is only justifiable to ward off asphyxia from œdema, tumefaction, or impaction of necrosed cartilage." It is true that cases have been published by Dr. Serkowski[2] and Dr. Ripley[3] which are opposed to this view, but I cannot accept these cases as establishing tracheotomy as a curative operation in laryngeal phthisis. In one of Serkowski's cases the patient survived the operation three years, and after death the lungs showed evidence of far advanced phthisis, but it is highly probable that the tubercular affection was developed long after the trachea had been opened; and in his other case there is no proof that the patient was really suffering from laryngeal phthisis. In Dr. Ripley's case the operation certainly prolonged the patient's life, but was in no sense curative. In opposing tracheotomy in laryngeal phthisis, except when there is urgent dyspnœa, I differ entirely from my accomplished pupil Dr. Beverley Robinson, who observes that in order "to obtain these latter (*i. e.*, favorable results) it seems indicated not to delay the operation, but rather to perform it so soon as the nature of the disease is obvious, and other means appear of no avail." During the last twenty years I have performed tracheotomy in a few cases of laryngeal phthisis—perhaps a dozen—but, although it has often relieved urgent dyspnœa, I cannot recall a single instance in which the operation delayed the pathological process. Far from giving rest to the larynx, the wearing of a canula, in my opinion, tends to irritate the windpipe.

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[1] Diseases of the Throat. 2d edition, New York, 1879, p. 516.
[2] Allgem. Med. Chi. Zeitung, Aug. 1878.
[3] Beverley Robinson: Op. cit.

PERICHONDRITIS OF THE LARYNX AND NECROSIS OF THE CARTILAGES.

Latin Eq.—Perichondritis laryngea et Necrosis cartilaginum.
French Eq.—Perichondrite laryngée et Nécrose des cartilages.
German Eq.—Entzündung des Perichondriums des Kehlkopfs und Necrose des Knorpels.
Italian Eq.—Pericondrite della laringee. Necrosi delle cartilagini.

Definition.—Inflammation of the perichondrium of the larynx, and necrosis (or, more strictly speaking, caries) of the cartilages, the latter being generally dependent on the former. In slight cases the morbid process is no doubt often arrested, slight enlargement of the cartilage remaining, whilst in syphilis extrusion of a part or whole of the affected cartilage may take place ; in other cases, however, when an abscess forms, hectic fever almost invariably supervenes and death follows.

History.—This affection was first described by Hormann [1] in 1791, and Albers,[2] gave a somewhat fuller account of the disease fifty years later, but Rühle first described it in detail. Dittrich,[3] Pitha,[4] and Wilks [5] subsequently reported cases, but it was only when diseases of the larynx began to be investigated with the laryngoscope that any considerable attention was devoted to the subject. Since then cases have been published by Türck,[6] Retslag,[7] Scheck,[8] Gerhardt,[9] Schroetter,[10] myself,[11] and the subject has been treated by Ziemssen [12] with his usual ability.

Etiology.—The disease is most common between the ages of twenty and forty, and the fact that it occurs very frequently as a sequel to laryngeal phthisis accounts for the greater incidence of the affection at that period of life. I have notes of its occurrence in forty-five autopsies; but I have met with it during life in many other cases, especially in phthisis and syphilis. Men are more subject to the disease than women, and in the forty-five autopsies thirty-three of the subjects were males and twelve females. The following table gives some information as regards the ages of the patients:

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[1] Von einer in Vereiterung übergehenden Halsentzündung Sammlung auserlesener Abhandlungen, Leipzig, 1791. Ryland has been referred to by some authors as having mentioned the subject of the disease of the cartilages of the larynx, but he only describes one case in which dysphagia was said to occur from premature ossification of the cricoid and arytenoid cartilages.

[2] Einige Krankheiten der Kehlkopfsknorpel, Gräfe und Walther's Journal d. Chirurg. und Augenhlk., xxix. 1840.

[3] Prag. Viertelj., iii. 1850.

[4] Ibid., Bd. i., 1857.

[5] Trans. Path. Soc., 1858.

[6] Wien. Mediz. Zeit., 1861, No. 50, and 1863, No. 9.

[7] Ueber Perichondritis Laryngea, Dissertatio, Berlin.

[8] Intelligenzblatt, 1872, No. 23.

[9] Archiv f. Klin. Med., Bd. xi. p. 24.

[10] Loc. cit , 1871.

[11] Trans. Path. Soc., vol. xxii.

[12] Cyclop. of the Prac. of Med., vol. vii. p. 814.

FORTY-FIVE AUTOPSIES,

In which Necrosis of the Cartilages was present.

Ages.		Ages.	
From 10 to 20 years...	0	From 40 to 50 years....	9
" 20 to 30 " ...	16	" 50 to 60 "	5
" 30 to 40 " ...	11	" 60 to 70 "	4

In three non-fatal cases the disease affected the upper part of the alæ of the thyroid cartilage (two the right plate and one the left plate), and there were small external abscesses in the neck. I have also seen the disease during life in four cases of cut-throat. In the forty-five autopsies (see Pathology, page 284), nineteen occurred in laryngeal phthisis, ten in carcinoma, six in tertiary syphilis, four in typhoid fever, two in chronic laryngitis, and three were examples of primary chondritis. These cases of primary inflammation of the cartilage all occurred in patients over sixty years of age; two were men and one a woman. One of them suffered from gout in the hand. My statistics, however, are not at all reliable as regards the relative frequency of perichondritis in different affections, for whilst I see many cases of phthisis, cancer, and syphilis of the larynx, I scarcely ever meet with typhoid fever; indeed, all the cases of that disease in which I found disease of the cartilage came under my notice formerly at the time that I was physician to the London Hospital. Retslag's statistics are based on post-mortem examinations at the Pathological Anatomical Institution at Berlin, and are of more value for illustrating the proportionate frequency of the primary diseases. In his experience, out of twenty cases of perichondritis, tuberculosis was the cause ten times, typhoid fever eight times, suppurative pleurisy once, and myelitis once. As a primary phenomenon the disease is very rare. But in addition to the cases which have occurred in my own practice, Türck[1] and Schroetter[2] have recorded examples. Rauchfuss[3] has also reported a case in a child three years old.

The idea of Dittrich[4] that the disease arises from ossification of the cricoid cartilage, leading to pressure of the soft parts against the vertebral column and subsequent perichondritis, is probably erroneous. In the three cases of disease of one of the alæ of the thyroid cartilage the patients were all markedly scrofulous, and I believe in these instances that the abscesses in the neck led to exposure of the cartilage and ultimately to its necrosis.

Symptoms.—The symptoms of *primary* chondritis are more marked than those of secondary inflammation of the cartilage. Dull aching pain, sometimes felt in the larynx and sometimes in the pharynx, with difficulty of swallowing, was present in each of my three cases, and after the abscess burst, the breath was very fetid. It must be borne in mind that in my cases it was the cricoid cartilage which suffered in every instance. In the *secondary* disease there is generally so much œdema that it is impossible to be certain as to the condition of the cartilages during life. The tumefaction in these cases usually even masks the ulceration which is almost invariably present. If, however, an ulcer be visible, a

[1] Klinik, etc., p. 207 et seq.
[2] Loc. cit.
[3] Loc. cit. p. 243.
[4] Loc. cit.

probe will generally detect the broken-down cartilage. Occasionally acute perichondritis is followed by general emphysema, and examples of this accident are recorded by both Wilks and Ziemssen. The symptoms vary according to the cartilage affected. A necrosed *arytenoid* cartilage can, indeed, sometimes be seen through the ulcerated mucous membrane, but when it has been expectorated its absence is not always apparent. In the annexed cut (Fig. 83) the appearance of the ary-epiglottic fold is shown after the left arytenoid cartilage had been expectorated. Even partial destruction of this cartilage generally causes complete immobility of the corresponding vocal cord, probably by giving rise to anchylosis. Necrosis of the posterior plate of the *cricoid* cartilage, according to its extent, gives rise to paralysis of one or both of the posterior abductors of the cords. In my three cases of primary chondritis, the mucous membrane over the arytenoid cartilage and the upper part of the cricoid cartilage was observed to be constantly covered with pus, but in no instance was the opening of the abscess seen during life, probably owing to its orifice being on a posterior surface of the cricoid cartilage. The symptoms of necrosis of the *thyroid* cartilage depend on whether the disease be *intra-* or *extra-laryngeal*. I do not think that internal disease of the thyroid cartilage can be diagnosed with certainty. In the two cases that I have met with, the necrosis affected the inter-thyroid plate, and was only discovered after death. When the disease communicates externally with the neck, the necrosed cartilage can be easily felt with a probe. In two of my three cases I was able to inject milk into the larynx through the fistulous track. In a similar instance Professor Ziemssen also succeeded in injecting a colored fluid, and Schroetter passed a probe through the fistula into the larynx, which became visible in the laryngeal mirror. The following statement shows the number of times each cartilage was affected in various diseases:

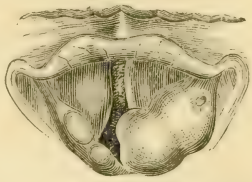

FIG. 83.—Perichondritis: Laryngoscopic Appearance after Expectoration of Right Arytenoid Cartilage.

NECROSIS OF THE CARTILAGES IN FORTY-FIVE AUTOPSIES.

Cricoid, in laryngeal phthisis (6 alone, 4 with arytenoid)	10	
" syphilis	1	
" cancer	3	
" typhoid	4	
" primary	3	
	—	21
Arytenoid, in laryngeal phthisis (11 alone, 4 with cricoid)	11	
" syphilis (4 times 1 cartilage, once both cartilages)	5	
" cancer	6	
" chronic laryngitis (lungs healthy)	2	
	—	24
Thyroid, in laryngeal phthisis	2	
" cancer	1	
	—	3

Diagnosis.—Primary chondritis or primary inflammation of the investing membrane may be suspected in the earlier stages of the disease

when there is a dull, aching, or boring pain, with enlargement of some portion of the framework of the larynx, but without much hyperæmia of the mucous membrane. At a later period the soft tissues generally become involved, and the action of one or both the vocal cords impaired. There is also often a fetid discharge. In secondary inflammation of the perichondrium its condition is often masked by the swelling of the mucosa and submucosa, but perichondritis may be surmised if, in the absence of cicatricial contractions, there is much distortion of any part of the larynx. When there is deep ulceration a probe can very often be passed through the opening, and the necrosed cartilage at once recognized.

Pathology.—In secondary inflammation of the cartilages, which, as already shown, is much the most common form, the morbid process almost always commences in the perichondrium. The fibrous investment of the cartilages becomes thickened, its individual fibres are separated and enlarged, and pus forms between them. At a later period a purulent collection takes places beneath the membrane, which thus becomes separated from the cartilage, and the latter, deprived of its vascular supply, undergoes molecular death. The affected cartilage is often of a dark gray, or even black color. The presence or absence of discoloration seems to depend on whether there is communication, through ulceration of the tissues, between the cartilage and the atmosphere. Where this communication does exist, as is most frequently the case, the surface, and sometimes even the entire thickness of the cartilage, is discolored. On microscopic examination at the earliest stages the cartilage corpuscles are found to be broken down, and they ultimately disappear by a process of fatty degeneration. The intercellular substance first becomes thickened and opaque, and subsequently undergoes a retrograde metamorphosis of the fibres into purulent matter. Occasionally the cartilages appear to undergo a kind of molecular absorption, and then seem greatly atrophied. An example of this condition is figured by Rühle.[1] In secondary inflammation of the cartilages the tissues around the perichondrium are always greatly swollen and saturated with pus or serum.

Prognosis.—The prognosis is very unfavorable as regards life, except in very slight cases, in those of traumatic origin, or where syphilis is the cause of the disease. In the latter case, although the morbid process may be arrested after tracheotomy has been performed, contraction of the laryngeal canal generally takes place, and this affection, though it can be palliated, is seldom cured.

Treatment.—In the acute stage of the disease little can be done in the way of treatment, except to relieve, as far as possible, the hyperæmia or œdema of the superjacent tissues. The former condition is met by the usual warm soothing inhalations, the latter by scarification. Should primary disease of the cartilages be diagnosed, two or three leeches should be applied to the neck, as nearly as possible over the seat of the affected cartilage, and repeated every other day, until either some beneficial effect is produced or the treatment appears useless. Tracheotomy often becomes necessary, and even in phthisis the patient's life may be prolonged by the operation. Where the posterior plate of the cricoid cartilage is the seat of the disease, the patient may be fed by means of the œsophageal tube; in one of my cases the patient, who was quite unable to swallow a drop of fluid, was kept in a state of perfect nutrition for nine weeks by this mode of feeding.

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[1] Loc. cit. p. 1.

In cases of syphilis and cut-throat, or in any condition where the inflammatory process is arrested, dilatation of the contracted laryngeal passage may be subsequently effected, and there are various mechanical measures which may be resorted to. Since the year 1862 I have used an instrument for this purpose (see page 192), but must confess that the results have been disappointing. The thickening of the cartilages, and in some cases the collapse of the cartilaginous framework from the falling inward of its walls, the density of the cicatrized tissues in syphilis, and the constant tendency which these fibrous structures show to recontract, render treatment very tedious, and a relapse generally follows as soon as mechanical treatment is discontinued. In order to meet the many difficulties which these cases present, Professor Schroetter,[1] of Vienna, has devised and carried out a method by which he has in many cases greatly increased the size of the trachea, and in some instances has enabled the patient to dispense altogether with the canula.[2] Dr. Labus, of Milan,[3] has also completely succeeded in one case.

In the first stage of treatment, Professor Schroetter employs catheters and rigid vulcanite tubes of graduated sizes, bent at a convenient angle for introduction into the larynx; the latter taper somewhat toward the point, so that they can be gradually worked into the stricture by the use of a moderate amount of force, and being open at both ends breathing is not obstructed during the operation. In order to prevent the patient from blowing or coughing particles of mucus into the face of the operator, a short piece of curved tubing, which can be turned in any direction, is fitted to the proximal end of the dilating tube. When the calibre of the canal has been increased to about the size of a No. 15 bougie, the second stage of treatment commences, and this constitutes, in fact, the distinctive feature of Schroetter's method. In order to affect any permanent dilatation of the stricture, it is requisite that the cicatricial tissue should be put on the stretch, or the collapsed cartilages kept apart, for several hours daily, and it need scarcely be observed, that on account of the irritation which would be set up in the pharynx and the consequent nausea, it would be impossible for any patient to retain a large staff in his larynx, passing out through the mouth, for more than a few minutes at a time. With the view of meeting this difficulty, Schroetter devised the plan of using pewter plugs, of various diameters, and about an inch and a quarter in length, which being introduced into the larynx are retained *in situ* by means of the tracheal canula (Fig. 52). As they neither interfere with deglutition nor respiration, with a little practice the patient becomes able to wear these plugs for the greater part of each day. The various circumstances under which this process of dilatation can be carried out have been well described by Dr. Hack[4] in a recent lecture.

In some cases dilatation can be effected from below, that is by passing plugs up from the tracheal opening. Professor Gerhardt[5] has reported a case cured in this way, but I have rarely found it practicable, and never permanently successful.

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[1] Beitrage zur Behandlung der Larynx Stenosen, Vienna, 1876.
[2] Private communication from Professor Schroetter.
[3] Il caterismo e la dilatazione meccanica nelle stenosi della laringe, Milano, 1876.
[4] Volkmann's Sammlung Klin. Vorträge, No. 52.
[5] Archiv. für Klin. Med., Bd. xi. p. 578.

LUPUS OF THE LARYNX.

Latin Eq.—Lupus laryngis.
French Eq.—Lupus du larynx.
German Eq.—Lupus des Kehlkopfs.
Italian Eq.—Lupus della laringe.

Definition.—Lupus (pathologically, similar to the same disease when occupying the skin of the nose) affecting the larynx, either primarily or secondarily.

Etiology, etc.—Lupus of the larynx is a rare disease, and but few authors make any mention of it whatever. Türck,[1] however, has met with five cases, Tobold[2] with two cases, and Ziemssen,[3] Grossman,[4] and Lefferts,[5] have each reported one case. The last-named author believes, indeed, that the malady, if sought for in cases of cutaneous lupus, would probably be more frequently found than is generally supposed. I have myself met with only two examples, which are hereafter reported (p. 287 et seq.). The causes of the affection are not better known than those of ordinary lupus, with which it is identical except in site, but it probably originates in some constitutional defect which is either of the same nature as scrofula or closely allied to it.

Symptoms.—The subjective phenomena of lupus of the larynx are in no way characteristic; in the early stages the patient generally complains, as in many other affections of this part, of slight sore throat and difficulty of swallowing, whilst, if the disease advances, there is often considerable dyspnœa. There is usually some hoarseness, and occasionally complete aphonia. Very frequently lupus is observed at the same time on some part of the face. On laryngoscopic examination the morbid appearances are marked, but still not of so peculiar a kind as to enable the observer at once to recognize the disease; for it offers some points of resemblance to syphilis, cancer, and phthisis, and these three affections must therefore be excluded by a careful investigation of the general condition and history of the patient. In Türck's cases there were ulcers on the epiglottis with loss of substance, chiefly in the form of a heart-shaped piece eaten out of the middle, as in my case here appended. In several instances growths have been noticed on the anterior surface of the posterior wall of the larynx. These appear as fleshy elevations of variable size, some of which have an irregular, jagged outline, whilst others are almost spherical. In Leffert's case the epiglottis was covered with small fleshy tubercles and worm-eaten ulcerations, and in one of my cases (Fig. 85) half the valve was studded with molluscum-like projections. Sometimes the mucous membrane of the pharynx is merely thickened, but the greater part of the hard and soft palate and uvula may be covered with reddish fleshy, wart-like growths, and the pharynx extensively ulcerated.

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[1] Zeitsch. d. Gesellsch. d. Aerzte zu Wien, 1859, No. 11.
[2] Kehlkopfkrankheiten, p. 307.
[3] Cyclopædia of Med., vol. vii. p. 848.
[4] Wien. Med. Zeitung. 1877. No. xx.
[5] American Jour. of Med. Sci., April, 1878.

Pathology.—According to Virchow,[1] the usual anatomical condition found in lupus of the larynx is presented by the following description of a case examined by him: An indurated cicatrix beset by thick knobs as large as a pea, extended from the middle of the dorsum of the tongue deeply down into its roots. The epiglottis was excessively hard, and was bordered by hard warts. From this part the tissues were hardened in a knotty manner as far down as the trachea. The arytenoid cartilages were deeply ulcerated, and surrounded by hard papillary outgrowths. According to the same investigator the lupus nodules are composed of a young and soft granulation tissue, which is usually very vascular. It contains small round cells, and originates in proliferation of the connective tissue, and not of the epithelium. The ultimate tendency of the morbid action is toward destructive ulceration, and in apparent healing, instead of a healthy and permanent cicatrix being produced, a tissue of low vitality is formed which is soon followed by a fresh outbreak of the disease in the same spot.

Diagnosis.—Lupus of the larynx is easily recognized when the characteristic skin affection is also present. In young subjects, also, there is not likely to be much difficulty in deciding as to the nature of the disease, except in cases of hereditary syphilis. When the laryngeal malady constitutes the only local manifestation of the disease, a careful investigation of the history and general condition of the patient must be made before arriving at a conclusion; if the question of syphilis arises, it will soon be settled by the administration of iodide of potassium.

Prognosis.—The generally intractable nature of lupous ulceration of the face is well known. Once established, the disease may last for the lifetime of the patient, entirely unrestrained by any means, surgical or therapeutic, that may be adopted for its cure. In the larynx, lupus does not usually appear to be a very dangerous affection, but occasionally the new formation is so abundant as to block up the glottis and necessitate tracheotomy, or the continued impediment to respiration may make a serious inroad on the constitution of the patient. The progress of disease in the larynx, however, appears, as a rule, to be very slow, and the malady is occasionally arrested.

Treatment.—Internally cod-liver oil should be administered, and, if the disease is active, its progress may sometimes be arrested by caustic applications. The solid nitrate of silver is the best remedy that can be employed for this purpose, but its effects should be carefully watched, and too extensive a cauterization of the diseased surface at one time should be carefully avoided. It may here be mentioned, however, that in Dr. Leffert's case, caustics were so badly borne that he was obliged to resort to "much milder treatment, in which a modified Lugol's solution and sedative applications played an important part, to the great comfort of the patient, but without amelioration of the local pathological changes."

CASES ILLUSTRATING LUPUS OF THE LARYNX.

In March, 1869, I was requested by my colleague, Mr. Cooper, at the London Hospital, to see Thomas P., aged fourteen, on account of difficulty of swallowing. I found him suffering from destructive ulceration of the alæ of the nose, and from thickening and extensive ulceration of the lips.

[1] Die krankhaften Geschwülste, Bd. ii. p. 490.

Between the nose and the mouth there was a dense white cicatricial tissue. The history of the case was that the nose became swollen nine years previously, and that after a fortnight ulceration appeared, which rapidly destroyed a portion of that organ and spread down to the lips. The patient stated that he had been in Guy's Hospital on several occasions, and that nitric acid had been applied under chloroform five times. This treatment resulted in healing of the tissues between the nose and the lips, but he had still an open ulcer involving the right ala of the nose and the septum, and nearly the whole of the superior margin of the upper lip, and for this he had applied to the London Hospital. The patient had a thick and slightly nasal voice, and complained that in swallowing "things often went the wrong way." A careful examination was made with a view of discovering any trace of syphilis or phthisis, but the lungs were perfectly healthy, and Mr. Cooper informed me that iodide of potassium had produced no effect whatever. The pharynx and posterior nares were seen to be healthy, but on laryngoscopic examination the epiglottis was found to be generally thickened, and to be ulcerated in the centre and along its free edge; the ary-epiglottic folds were also slightly swollen (Fig. 84). There was nothing at all characteristic of lupus about the epiglottis, and had the patient not been suffering from lupus of the face, I should certainly have attributed the laryngeal affection to tertiary syphilis. In view, however, of the facial phenomena, I felt no doubt that the thickening of the epi-

FIG. 84.—Lupus of the Larynx, showing Thickening and Ulceration of the Epiglottis.

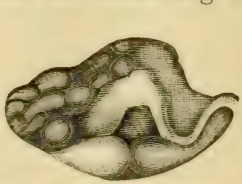

FIG. 85.—Lupus of the Larynx, showing Molluscum-like Growths on the Epiglottis.

glottis was due to lupus. I saw the patient two years later, and found that under Mr. Cooper's treatment, consisting principally of the local applications of strong nitric acid, and the internal use of cod-liver oil, the cutaneous ulcerations had ceased except at the left side of the mouth, where there was still a small ulcer. The larynx was in the same condition as when I first saw it, the ulcer neither having healed nor increased.

Elizabeth B., a native of Cork, aged eighteen, applied to me in June, 1877, on account of difficulty in swallowing and slight hoarseness. The whole of the left side of the nose to the inner canthus of the left eye had been destroyed by ulceration which had lasted six years, but had now healed up except at the cartilaginous portion of the septum. The patient stated that some years previously, in one of the Dublin hospitals, a strong acid had been applied to her face, and had done her a great deal of good. On examining the throat, the uvula was found to be greatly thickened and elongated, measuring, as nearly as possible, two centimetres, both in length and breadth; the posterior pillars of the fauces were so much thickened that they were each about as broad as a man's thumb, leaving only a narrow space (about half a centimetre) of the posterior wall of the pharynx visible. On making a laryngoscopic examination, the epiglottis was seen to be enlarged, pendent, and immobile, its right side being covered with molluscum-like growths, and its centre occupied by a smooth and slightly depressed cicatrix (Fig. 85). Owing to the

general tumefaction, only a portion of the arytenoid cartilages could be seen; the mucous membrane over them was slightly swollen. This patient was treated by large doses of iodide of potassium and insufflation of bismuth powder for six weeks without any effect; she subsequently remained under observation for seven months, during which time various local remedies were used, but without my being able to notice any change in the pharynx or larynx.

LEPROSY OF THE LARYNX.

(Synonym: Elephantiasis Græcorum.)

Latin Eq.—Lepræ veræ laryngis.
French Eq.—Lèpre du larynx.
German Eq.—Aussatz des Kehlkopfs.
Italian Eq.—Lepra della laringe.

Definition.—An infiltration of the laryngeal structures by a tubercular granulation-tissue, generally leading to destructive ulceration of the part. The disease occurs only as a concomitant of general leprosy.

Symptoms.—The investigations of Virchow[1] have shown that even in the middle ages hoarseness and dyspnœa were so generally regarded as the signs of leprosy, that the possession of a "*vox rauca*" was almost sufficient to cause an individual so afflicted to be stigmatized as a leper. Since the introdution of the laryngoscope several practitioners who have met with general leprosy have endeavored to ascertain the condition of the larynx by actual inspection. Amongst these Wolff,[2] Gibb,[3] Schroetter,[4] and Elsberg[5] have furnished us with the most systematic observations, and I am now able to add three cases. Wolff, at Madeira, found chronic catarrh of the larynx, with considerable swelling, and vascularity of the epiglottis. The mucous membrane of the arytenoid cartilages and the ventricular bands was of a dark bluish red color, much thickened and apparently loosened from the submucous tissue. The vocal cords were thickened, and of a yellowish red hue. In addition, small papillary growths were present in different parts of the larynx, but rarely on the vocal cords. At the same time muscular pareses, interfering with phonation and respiration, could be detected by the laryngoscope. In Gibb's case there was great loss of substance of the epiglottis and vocal cords, together with a large amount of thickening of the other parts of the larynx. Schroetter found isolated tubercles, or uniform thickening of the various tissues of the larynx. In some cases laryngeal stenosis was developed to such an extent that the calibre of the canal was reduced to the diameter of an ordinary lead pencil. In Elsberg's cases the epiglottis was enormously thickened and covered with tuberous masses, whilst smaller growths occupied the ary-epiglottic folds. In my cases there was generally thick-

[1] Die krankhaften Geschwülste, Bd. ii. p. 519.
[2] Virchow's Archiv, Bd. xxvi. p. 44, 1863.
[3] Diseases of the Throat, p. 272, London, 1864.
[4] Laryngologische Mittheilungen. ii. p. 84, 1874.
[5] Elsberg and Rice: New York Med. Record, vol. xv. No. 1.

ening of the epiglottis, and in one instance there was considerable œdema of the valve, and two small ulcers near its centre (Fig. 86), but in no instance did I meet with distinct tubercles.

Pathology.—According to Virchow[1] the pathological process in leprosy of the larynx consists in a development of tuberculous granulations on the mucous membrane, which are scarcely distinguishable from syphilitic condylomata or follicular abscesses. They possess, however, much more hardness and vascularity. In some cases tubercles are not present, but a grayish white non-ulcerating infiltration of the mucosa and submucosa. The tendency is toward ulceration, but the course of the disease is so extremely slow that in some cases, though progressive, it never attains this stage.[2] In Virchow's cases the base of the ulcerations was formed by indurated tendinous tissue, which penetrate deeply into the surrounding structures. The extraneous granulation-tissue bears a close resemblance to the new formations of lupus, and consists microscopically of simple spindle-shaped and stellate connective-tissue cells. By active division of the cells and nuclei the intercellular substance soon becomes almost obliterated or absorbed, until all the normal components of the part disappear. The morbid cell infiltration has a considerable proliferative character, the individual cells being round, pale, slightly granular, easily destructible, and usually possessing a rather large granular nucleus and a nucleolus. The great majority of these cells are superior in size to red blood corpuscles, some attaining the dimensions of the largest mucous corpuscles.

Diagnosis.—The diagnosis of laryngeal lepra is simple, the internal malady never occurring except as a concomitant of the more pronounced forms of general lepra.

Prognosis.—The prognosis is unfavorable, the laryngeal phenomena often constituting only a small part of an extensive and terrible disease of the cutaneous system.

Treatment.—It would be futile, in the present state of our knowledge, to discuss any measures for the radical cure of the disease. The various local phenomena must be treated according to the general rules laid down in the articles on Chronic Laryngitis and Œdema of the Larynx. If the dyspnœa is urgent tracheotomy must be performed.

CASES ILLUSTRATING LEPROSY OF THE LARYNX.

George L., aged eighteen, sent to me by Mr. Erasmus Wilson, December, 4, 1865. The face of the patient and the soles of his feet are covered with small round shining tubercles. The same condition exists to a less extent on the palms of the hands. The patient's voice is strongly nasal, and the mucous membrane of the nares so thickened that both the anterior and posterior nasal passages are nearly completely obstructed. The epiglottis is very much thickened, but there are no distinct tubercles and no ulceration. There is no difficulty in swallowing.

H. E., aged twenty-seven, a Norwegian sailor, from Bergen, whose ship is in the London Docks, came with his brother (see next case) to the London Hospital in February, 1869, on account of difficulty of breathing and swallowing. His forehead and right eyebrow were covered with soft,

[1] Loc. cit.

[2] Thomas: Beiträge z. path. Anat. d. Lepra Arab. Virchow's Archiv, Bd. lvii. p. 455, 1873.

shining, yellowish brown, irregular, but generally round or oval, tumors, varying in size from a pea to a marble. The right ear was much swollen and of purple color. The pharynx showed slight thickening of the right side, especially of the right posterior pillar, which projected centrally as far as the uvula, and blocked up the view of the posterior nares. The epiglottis was greatly thickened and œdematous, especially on the left side, and there were two small ulcers on the free edge of the valve near its centre. There were, however, no distinct tubercles.

Fig. 86.—Leprosy of the Epiglottis, showing Great Thickening and Slight Ulceration.

A. E., aged twenty-five, brother of the last patient, and like him a sailor. Nose and lips swollen, and covered with small round shining tubercles. Hair had fallen off eyebrows and beard. Had a hoarse voice, but no difficulty of swallowing. Papilla at back of tongue enormously hypertrophied. Uvula thickened; three small ulcers on the posterior wall of pharynx. Laryngoscopic appearances: A slightly congested and highly succulent condition of the mucous membrane of the larynx. No ulceration nor tubercles.

FRACTURES AND DISLOCATIONS OF THE LARYNX.

Latin Eq.—Fracturæ cartilaginum laryngis. Laxaturæ laryngis.
French Eq.—Fractures et luxations des cartilages du larynx.
German Eq.—Fracturen und Verrenkungen der Kehlkopfsknorpel.
Italian Eq.—Fratture e lussazioni delle cartilagini della laringe.

Fractures.—These injuries are of unfrequent occurrence, but nevertheless certain authors have succeeded in collecting a considerable number of cases from various sources.[1] In 1868 Hénoque[2] published a monograph based on the consideration of fifty-two cases, which comprised all that had previously been recorded by medical writers. It appears that the larynx cannot be fractured by concussion unless it is supported to some extent on the vertebral column, as when the body is supine—the mobility of the organ and the elasticity of its cartilages, when the neck is not fixed, preventing a direct blow from producing more than a contusion of the soft parts.[3] In garrotting, the larynx is often fractured, not by pressure backward against the vertebral column, but by lateral compression of the wings of the thyroid cartilage. It is probable that ossification of the cartilages renders the larynx more brittle and liable to break under the influence of violence. As Dr. Panas judiciously observes,[4] a prema-

[1] See Gurlt: Handbuch der Knochenbrüche, p. 316; also Hénoque: Gazette hebdomad., 1868, No. 39, 40.

[2] Ibid.

[3] See the experiments made by Keiller (Edin. Med. Journ., 1856, p. 824); Cavasse: Gazette hebdom., 1861, p. 372; Helwig: Casper's Vierteljahrschrift, 1861 Bd. xix. p. 340; and Gurlt: Loc. cit.

[4] Annales des Maladies de l'Oreille, etc., Mars, 1878.

ture senility, whether produced by alcoholism or otherwise, predisposes the cartilages to suffer from the effects of injuries. The thyroid is the cartilage most usually fractured, whilst in those cases where the cricoid suffers, the injury is generally more extensive and dangerous. An analysis of Hénoque's cases, so far as the cause and exact seat are definitely stated, shows that 15 resulted from violent manual compression, 26 from falls, accidents with machines, and rolling vehicles, 4 from hanging, whilst 5 occurred in lunatics in some unexplained way through the wearing of the straight-waistcoat. In 23 instances the thyroid alone was fractured, in 7 the cricoid alone, and in 7 both these cartilages, whilst in the remaining cases the hyoid bone, larynx, and trachea, all suffered together from a common injury.

Symptoms.—The symptoms of fracture of the larynx vary considerably according to the extent of the injury done to the cartilages and the soft parts connected therewith. I have myself met with only one case:

The patient was an acrobat, and whilst lying flat on the floor another gymnast had jumped on his neck; he had often done this before without any bad effect, but on the occasion referred to great pain was felt at the time, and soon afterward a feeling of constriction was experienced in the throat, and the patient had great difficulty in swallowing. I saw him three days after the accident, in July, 1865. There was a vertical fracture of the thyroid cartilage in the median line. The soft parts over the anterior part of the larynx were not at all swollen though slightly ecchymotic. The two alæ could be easily made to move on each other, and produced distinct crepitation. A laryngoscopic examination showed considerable œdema and redness of the epiglottis. The patient suffered from complete aphonia and great dysphagia. Strips of plaster were applied transversely across the thyroid cartilage, and the epiglottis was scarified. At the end of a few days the patient was able to swallow well, but the hoarseness remained for six weeks; at that time the cartilage had completely united, and there was no trace of a fracture.

The usual symptoms of fracture of the larynx are dyspnœa, cough, expectoration of mucus tinged with blood, and more or less pain and tenderness in the part. Emphysema of the neck is also likely to supervene, and in some cases the air may penetrate into the cellular tissue of the chest and back, or even further. On manipulation, the broken cartilages will crepitate when the fragments are rubbed against each other, whilst occasionally over-riding of the fractured edges gives rise to a perceptible deformity.

Prognosis.—Fractures of the larynx are always attended with considerable risk, as the violence which occasions them is generally great, and the injury to the soft tissues profound. To judge from Hénoque's cases, fracture of the cricoid cartilage is an invariably fatal occurrence, but if tracheotomy be promptly performed some of these cases might probably be saved.

Treatment.—Unless the symptoms are very slight it will be advisable to perform tracheotomy as soon as possible, otherwise the patient, although progressing favorably, is not unlikely to perish suddenly on making some slight movement.[1] Hüter[2] goes so far as to say that "as soon as fracture

[1] See a case reported by Fredet: Quelques considérations sur les fractures traumatiques du larynx, Paris, 1865, p. 5.

[2] Pitha und Billroth's Handbuch, Erlangen, 1871, p. 12.

of the larynx has been diagnosed tracheotomy should be performed, and that even in cases where the diagnosis is not quite certain, the operation should nevertheless be carried out. In no case," he observes, "should the practitioner wait till a fit of suffocation comes on, as such an attack may supervene so very suddenly." If the cartilages are much crushed it will perhaps be best to lay open the whole length of the larynx, and endeavor to replace the fragments in their proper position. Dr. Panas [1] suggests that in some cases where tracheotomy is necessary the fractured portions of the laryngeal cartilages may be kept in proper apposition, and the patency of the laryngeal canal preserved, by the introduction of a small hollow india-rubber plug into the larynx from the tracheal opening and its subsequent inflation. Leeches should be applied to the neck, if there is much inflammatory tumefaction; and ice, both externally and internally, is sometimes of service. In cases of extreme injury, extirpation of the larynx or resection may have a future.

Dislocations of the Larynx.

Those luxations which occur between the larynx and hyoid bone will be referred to in the next section, and here intra-laryngeal dislocations alone will be briefly described. Examples of this condition have been reported by Sidlo [2] and Stoerk.[3] In Sidlo's case both the arytenoid cartilages were dislocated forward and downward, so that their bodies assumed a horizontal position. The dislocation appears to have been the result of the contraction of a syphilitic cicatrix on the posterior surface of the cricoid cartilage. In Stoerk's two cases the left arytenoid cartilage was in each instance dislocated transversely inward, and there was at the same time considerable tumefaction of the affected cartilage. Both patients were men whose voices had been of a falsetto character from childhood. One case appears to have resulted from cicatricial contraction after diphtheria; in the other the etiology was altogether unknown.

Eversion of one or both the ventricles is another rare form of intra-laryngeal dislocation. Of this condition only three illustrations [4] are on record, and in only one of these (that of Dr. Lefferts [5]) was the accident recognized during life. In the latter case both ventricles were prolapsed, and the left one enormously hypertrophied. The accident appears to have happened during sleep, and had occurred twenty years before the patient came under Dr. Lefferts's notice. Since the time of its occurrence the patient had been hoarse, and latterly there had been considerable dyspnœa. Dr. Lefferts cured his patient by performing thyrotomy and extirpating the everted ventricles.

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[1] Op. cit. p. 4.
[2] Ziemssen's Cyclopædia, vol. vii. p. 968.
[3] Wiener Med. Wochenschrift, No. 50, 1878.
[4] Mackenzie: Growths, etc., p. 34.
[5] New York Med. Record, June 3, 1876.

FRACTURE AND DISLOCATION OF THE HYOID BONE.

Latin Eq.—Fracturæ et luxaturæ ossis hyoides.
French Eq.—Fractures et luxations de l'os hyoïde.
German Eq.—Fracturen und Verrenkungen des Zungenbeins.
Italian Eq.—Fratture e lussazioni dell' osso ioide.

Fracture.—The hyoid bone is occasionally fractured, and several examples of this injury are on record. The occurrence, however, is very rare, and no practitioner appears to have encountered more than one case. Gibb [1] has treated the subject almost exhaustively in a monograph based on the consideration of thirteen examples collected from various sources. It appears that the cornua are the only parts of the bone likely to be broken, at least in the adult, as in only one of the thirteen cases was the body fractured, the patient being a child aged six years. Of the remaining examples the right cornu was broken in four, and in five the left. In one case both the greater cornua were fractured, whilst in two the precise nature of the injuries was undetermined. Fracture of the hyoid bone is usually caused by forcible manual compression, as in garrotting, hanging, bowstringing, or by direct violence, as by falls or blows on the neck. The bone may also be fractured by excessive action of the muscles of the part.[2]

As regards symptoms, there is usually considerable pain in the neck, with inability to turn the head. Extreme odynphagia is also commonly present. The voice is generally much affected, and the patient can only speak with pain and effort, whilst occasionally the injury may produce so much narrowing of the glottis as to threaten death by asphyxia. On examining the throat the fragments will usually be found to be widely separated, and true crepitus is seldom met with. Swelling, ecchymosis, and even lacerations of the mucous membrane of the mouth, are present with more or less frequency. The following case fairly illustrates the accident:

In November, 1864, a patient came to the Hospital for Diseases of the Throat, suffering from great difficulty of breathing, also from dysphagia and great pain in the throat. The man was a bricklayer, and the previous day he had fallen about thirty-five feet from the scaffolding of a house. He had cut the right side of his face and had greatly contused the right shoulder, but he was not aware of any other injury. There was considerable swelling, and some redness between the angle of the jaw and the thyroid cartilage on the right side, and on making a careful examination of the neck the right greater cornu of the hyoid bone was evidently separated from the body of the bone. The patient was unable to protrude his tongue, as it caused so much pain, and no laryngoscopic examination could be made. Six leeches were applied over the seat of the injury, but the fractured bone could not be "set," as any attempt to manipulate it caused very great pain. On the following day the patient was quite unable to swallow, and it became necessary to feed him with an œsophageal tube.

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[1] On Diseases and Injuries of the Hyoid or Tongue Bone, London, 1862. See also Pitha and Billroth's Archiv, vol. iii.: Fracturen des Kehlkopfs.
[2] See Gibb, op. cit.

This procedure had to be carried out for eleven days, when the patient sufficiently recovered his power of swallowing. At the end of a month from the time of the accident the fracture was completely united, a superabundant amount of callus having been thrown around the broken ends of the bone.

The treatment of fractures of the hyoid bone is sufficiently obvious on perusal of the foregoing case. Local bloodletting is advisable if there is much swelling, whilst rest and silence must be strictly enjoined. Sedatives may be given to the patient, and feeding must be carried out, if necessary, by an œsophageal tube. If, however, the passage of the tube causes much pain, the patient must be fed by nutritive enemata. Should symptoms of asphyxia supervene, tracheotomy must at once be resorted to, but scarification of the interior of the larynx may suffice if there is only slight œdema. If the local inflammation is great the patient should suck ice continually, and ice or cold lotions should be applied to the neck externally.

Dislocation.—This is an occasional occurrence, but as the symptoms are not very obvious, the condition is probably often overlooked. Gibb [1] has collected several cases, some of which came under his own observation. The causes of the luxation appear to be most frequently a relaxation of the muscles and tissues of the part, which allows of an undue amount of motion. The accident may result from a violent strain, but is more apt to occur when tumors of the neck encroach laterally on the hyoid bone. In several of the examples recorded the dislocation seems to have been almost chronic in its character, and liable to continual recurrence throughout the whole of the patient's life.

I have met with three cases of dislocation of the hyoid bone. Two of these were caused by the pressure of tumors—one cancerous, the other lymphomatous. The third case occurred in a clergyman who had the power of producing the affection whenever he desired,[2] but in whom it also often occurred involuntarily. In none of these cases were the local symptoms caused by the displacement at all serious. There was no dysphagia, and only slight hoarseness which might have been due to other causes.

Several preparations in anatomical museums illustrate displacement of the hyoid bone by tumors of the neck, such as bronchocele,[3] and malignant growths of the tongue,[4] pharynx,[5] and œsophagus.[6] In a case brought before the Pathological Society [7] and reported on by Gibb, a medullary cancer as large as an orange was situated above and to the right of the thyroid cartilage, overlapping its right wing. The body of the hyoid bone was pushed obliquely to the left side of the thyroid cartilage, its right horn being much displaced upward, whilst its left horn rested on the superior border of the thyroid cartilage.

The dislocation can generally be easily reduced by throwing the head backward, relaxing the lower jaw and gently rubbing the displaced bone. The parts may be subsequently strengthened by the cold-water douche

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[1] Op. cit.
[2] Compare the analogous case of Dr. Ripley, recorded by Gibb (op. cit.).
[3] Univ. Col. Hosp. Mus. 550, W. 5.
[4] St. George's Hosp. Mus. Catalogue, L. ii.
[5] Coll. Surg. Mus. 1095 and 1096.
[6] Ibid
[7] Trans., vol. xii.

and stimulating applications. If a generally relaxed condition of the tissues throughout the body prevails, suitable tonic and analeptic measures are called for.

WOUNDS OF THE LARYNX.

Latin Eq.—Vulnera laryngis.
French Eq.—Plaies du larynx.
German Eq.—Wunden des Kehlkopfs.
Italian Eq.—Ferite della laringe.

Definition.—Incisions, punctures, contused or lacerated wounds of the larynx from without inward, whether homicidal, suicidal, or accidental.

Etiology.—Wounds of the larynx are rare in military surgery, only 6 cases occurring amongst 10,000 wounded.[1] In civil practice, however, owing to the frequency with which the part is injured in suicide, the injury is common. Out of 158 cases of cut-throat collected by Durham,[2] in 61 the wound was inflicted on the larynx, and 45 were through the thyro-hyoid membrane. In 58 cases analyzed by Horteloup [3] 86 occurred between the lower margin of the hyoid bone and the upper edge of the first ring of the trachea. According to Malgaigne,[4] young men, when making suicidal assaults on the throat, as a rule wound themselves above the larynx; whereas in old men the injury is generally inflicted below the cricoid cartilage. The reason of this difference is that old men usually find a difficulty in elevating the chin and throwing the head well back. Punctured wounds of the larynx are generally the result of thrusts made with a bayonet,[5] stiletto, or foil, or by some pointed piece of metal or a nail. These punctured wounds are apt to give rise to emphysema of the neck, sometimes causing serious dyspnœa.[6] Gunshot wounds are generally of a somewhat contused character, but a bullet will sometimes pass through the neck leaving only its track in the thyroid cartilage; or on the other hand it may carry away the greater part of the larynx. A solitary instance is on record in which a bullet fractured the thyroid cartilage without destroying the skin.[7] As a rule, the bullet does not remain in the larynx, but if not removed finds its way to the root of the neck. Four preparations illustrating gunshot wounds are to be found in the Army Medical Museum.[8] In the first instance the ball fractured the lower jaw, passed through the thyro-hyoid membrane, and carried away the epiglottis. In the second the anterior and superior part of the thyroid cartilage was carried away by a bullet, which also fractured the humerus. In the third the ball passed into the larynx from the side, and wounded

[1] Witte: Archiv. für Klinische Chirurgie, Bd. xxi. 1ste C. p. 186.
[2] Holmes' Surgery, vol. ii. p. 441.
[3] Plaies du Larynx, etc., Paris, 1869. See also a valuable Article in Pitha-Billroth's Handbuch, vol. iii. by Dr. George Fischer: Wunden des Kehlkopfs.
[4] Horteloup, op. cit. p. 17.
[5] Durham, op. cit. p. 447.
[6] Beach: New York Med. Journ., March, 1877.
[7] George Fischer: Deutsche Chirurgie, 1880, Lief. 34, p. 132.
[8] Nos. 202, 648, 657, 1440.

the epiglottis. In the fourth and last case the bullet stuck fast in the upper part of the thyroid cartilage.

Symptoms.—Incisions into the larynx (except in the case of surgical operations) are almost invariably transverse. Considerable difference of effect is observed, according as the opening is *large* or *small.* In the former case, if the cartilages are divided entirely through, the wound gapes widely through the action of the muscles which elevate and depress the larynx. There is not usually much hemorrhage, but asphyxia may occur rapidly through some part, such as a piece of the epiglottis or one of the arytenoid cartilages falling into the glottis and blocking it up. In extensive wounds of the larynx, the voice is usually altogether extinguished. In small wounds or punctures of the larynx the most prominent symptoms are the result of internal hemorrhage and emphysema of the cellular tissue of the neck, chest, or even of the whole body. A clot sometimes quickly forms in the trachea or bronchi, and causes death by suffocation. In all cases, if the first dangers of the wound are escaped, subsequent inflammation with tumefaction and formation of pus is very likely to place the life of the patient in jeopardy. In illustration I need only refer to the case recorded by Sir C. Bell,[1] in which a girl plunged a small penknife into her larynx; some months later exuberant granulations arose which filled up the glottis and caused death by suffocation. One of the commonest sequelæ is the formation of a dense web across the larynx, whilst more or less enlargement of the cartilages, from chronic inflammation, is seldom absent. Occasionally a fistulous aperture leading into the larynx remains after the surrounding parts have healed up, not only showing no tendency to spontaneous closure, but resisting all measures except those of a rhinoplastic character. In a case sent to me by Dr. Sutton, of Dover, there was an opening as large as a shilling several years after the wound was inflicted.

Prognosis.—Out of 88 cases of large wounds 67 patients recovered and 21 died. In 21 instances of small wounds there were 10 recoveries and 11 deaths.[2] Few patients recover without some modification of the vocal function, but the prognosis in respect to this point depends on the relation of the incision or puncture to the vocal cords. It will be remembered that the danger to respiration does not terminate with the healing of the wound or the relief of the first symptoms. Subsequent cicatricial narrowing of the windpipe may require that the air-passage should be opened, even if that operation was not at first required, or if tracheotomy was performed in the first instance it might either prevent the removal of the tracheal canula, or render tracheotomy necessary a second time.

Treatment.—The general treatment will be discussed under the head of Cut-Throat, it being only necessary to remark here that, in the case of gunshot wounds, or jagged cuts, however produced, it is very important to see that any loose fragments of epiglottis, arytenoid cartilage, or mucous membrane, are altogether removed; and that in a punctured wound, any resulting emphysema should be relieved by scarification of the skin. The cicatricial narrowing of the windpipe, which so often results, must be treated by the mechanical measures described at page 284.

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[1] Surgical Observations, vol. i. p. 45.
[2] Horteloup, op. cit. p. 86.

Burns of the Larynx.[1]

Samuel Cooper[2] and Marjolin[3] first called attention to the frequency of dyspnœa in cases of burn, but it remained for Ryland[4] to point out that this condition was frequently due to burning flame or highly heated air. Since then Durham[5] and Cohen[6] have reported cases. In most of the recorded cases the upper portion of the body was the seat of the burn, but in some instances the lower extremities alone suffered. The *symptoms* are generally great pain in the throat, difficulty of swallowing, dyspnœa, aphonia, and the presence of a quantity of black carbonaceous matter in the sputa. The symptoms usually come on a few hours after the accident. On examining these cases great inflammation of the fauces is generally to be seen, and the larynx in one case, reported by Dr. Cohen, was in a state of acute œdema. There is generally great nervous prostration. The *prognosis* is very serious; it depends not only on the extent and depth of the burn, but also the age and vigor of the patient must be taken into consideration.

The local treatment should consist in making the patient suck ice and using insufflations of morphia; but if there is much œdema, scarification should be employed, and, if necessary, tracheotomy must be performed.

FOREIGN BODIES IN THE LARYNX.

Latin Eq.—Corpora adventitia in larynge.
French Eq.—Corps étrangers dans le larynx.
German Eq.—Fremde Körper im Kehlkopf.
Italian Eq.—Corpi stranieri nella laringe.

Definition.—Foreign bodies generally introduced into the larynx from without, most frequently through the mouth during mastication or deglutition, and only very rarely entering through a wound in the neck. Occasionally, however, they pass upward from the trachea or œsophagus.

Etiology.—A complete collection of all the foreign bodies that at one time or another have found their way into the larynx would probably comprise specimens of every known substance.[7] Flesh, bread, fragments of bones of all edible quadrupeds and fish, stones of various species of fruits, nutshells, grains of corn, peas, beans, shells of mollusks, coins, buttons, pebbles, artificial teeth with their fittings, are examples of the foreign matters that most frequently become impacted in the larynx. The first class of substances, *i. e.*, those connected with alimentary matters,

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[1] This subject might perhaps have been more conveniently considered in connection with Scalds of the Larynx (page 206), but having been hitherto omitted must be briefly referred to here.

[2] Dict. of Pract. Surg., art. Burns.

[3] Dict. de Médecine, art. Brulure.

[4] A Treatise on Diseases and Injuries of the Larynx and Trachea, p. 274, 1837.

[5] Holmes's System of Surgery, vol. ii. p. 466, second edition.

[6] Cohen: Inhalation, its Therapeutics and Practice, 1876, p. 294.

[7] See Gross: Treatise on Foreign Bodies in the Air-passages, Philadelphia, 1854.

usually gain admission during mastication, whilst the person is laughing or talking; less frequently during the act of deglutition. Foreign bodies of metallic composition are occasionally impacted in the larynx of children, who amuse themselves by putting coins, buttons, small toys, etc., in the mouth. In rarer instances teeth, real or artificial, or tooth plates, become loosened during sleep and drawn into the glottis. It is, indeed, very frequently during sleep that the metallic bodies mentioned above find admittance into the air-passages in children who have gone to bed with them in their mouths. An accident of this kind occurred to a lad at Wisbeach in the year 1876.[1] The boy went to sleep with a toy-engine in his mouth, and during the night it passed into the windpipe. Dr. Bury, who was called to the case, found it necessary to perform tracheotomy. The cause of the sudden attack of dyspnœa was not known at the time, and some months later Dr. Bury sent the patient up to me at the Hospital for Diseases of the Throat, and I transferred the case to my principal clinical assistant, Dr. Samuel Johnson, now of Baltimore. The little engine was found to be so deeply embedded in the subglottic region that it could only be extracted after Dr. Johnson had performed thyrotomy. The patient made a complete recovery, though his voice has remained up to the present time (July, 1879), slightly hoarse. Peas or puff-darts are sometimes sucked in through tubes; and leeches applied inside the mouth will occasionally make their way downward, though more frequently these animals get into the larynx from drinking dirty water, an accident which has often happened to soldiers on march. Dr. Massei[2] succeeded in removing from the pharyngo-laryngeal sinus a living leech which had found its way into that situation whilst the patient was drinking some impure river water a fortnight previously. Foreign bodies may also become fixed in the larynx, having previously passed upward through the trachea or œsophagus. A curious case is related by Edwards,[3] of a boy æt. eight, in whom a bronchial gland became detached, passed by an ulcerated opening into one of the bronchi, and was thence expelled up the trachea during violent exertion, so as to become impacted in the rima glottidis. The epiglottis itself may be drawn into the larynx and become spasmodically fixed in that situation. Dr. Solis Cohen[4] remarks that this accident "usually occurs during eating," but that he has "known it occur during swallowing of saliva and threaten asphyxia." This author refers to a case reported by Rühle,[5] and adds that "it is not improbable that some cases of otherwise unaccountable sudden death at a meal may be due to this cause." If an inspiration be taken incautiously during the act of vomiting, as sometimes occurs in fits of drunkenness, some of the matters passing up from the stomach may be drawn into the larynx and cause suffocation. Foreign bodies may also gain access to the cavity of the larynx directly from without, *i. e.*, by penetrating its walls when driven forcibly, as in the case of bullets, flying fragments of metal, stone, etc. Some idea of the frequency with which foreign matters become fixed in different parts of the air-passages, may be gathered from an analysis of 166 cases made by Bourdillat.[6] Of these in 80 instances the foreign body was arrested in the trachea, and 35 in the larynx, in 26 in the right bronchus, and in 15 in

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[1] Archives of Clin. Surg., Dec., 1876.
[2] Il Morgagni, Oct., 1874.
[3] Med.-Chir. Trans., vol. xxxvi.
[4] Op. cit., second edition, p. 615 et seq.
[5] Op. cit. p. 13.
[6] Gazette Méd., 1861, p. 135. See also a further paper by the same author on Three Hundred Cases of Foreign Bodies in the Air-Passages.—Gazette Méd., 1868.

the left bronchus. According to Durham,[1] however, the larynx is the most frequent site of impaction of a foreign body. Out of 15 cases collected by that writer, in 7 the larynx arrested the foreign substance, in 5 the trachea, in 2 the right bronchus, and in 1 the left bronchus.

Symptoms.—These vary considerably, according to the size of the foreign body and the mode in which it has become impacted. If fixed in the rima glottidis, and large enough to fill that opening, death may be almost instantaneous, unless the convulsive efforts of the patient at respiration succeed in dislodging it. On the other hand small bodies, such as fish bones, may remain in the larynx for an indefinite period without interrupting respiration, merely giving rise to cough and sensations of discomfort in the part.[2] Sometimes even the temporary impaction of a foreign body gives rise to hemorrhage from the surface of the mucous membrane, and Sommerbrodt [3] has reported a case in which the mere contact of a foreign body in the act of deglutition led to the immediate formation of a small blood-cyst on the dorsal surface of the posterior wall of the larynx. The cyst was opened and the patient at once cured. In many cases when the presence of the foreign body does not at first directly obstruct respiration, it does so afterward indirectly by causing inflammation and tumefaction of the soft parts of the larynx. In another class of cases the foreign body may at first allow the freedom of respiration, but subsequently take up an altered position,[4] which immediately menaces life. Thus a substance of irregular shape may pass the glottis and become arrested in the trachea, and after a variable interval be driven upward during a fit of coughing, so as to become firmly wedged into the rima glottidis. Under these circumstances sudden death may be the result. When the foreign body is impacted in one of the ventricles [5] it cannot generally be moved, and if it passes into both ventricles it will most likely require to be broken or crushed before it can be extracted (see case, page 302). In some instances considerable danger accrues, not from the position of the foreign body, or from inflammation, but from violent spasm of the glottis, brought about by the irritation applied directly to the part. As a rule great anxiety and terror on the part of the patient accompany the entrance of any foreign body, however small, into the air-passages, and in many cases somewhat mask the real importance of the accident. In those cases where the foreign body remains in the larynx without causing immediate danger to life by asphyxia, pain is a prominent symptom. Sharp and angular bodies of any size cause very acute and continuous pain when they become impacted so as to press against the contiguous soft parts, and, of course, quickly give rise to high inflam-

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[1] Holmes's System of Surgery, vol. ii. p. 477.

[2] The case of the poet Anacreon, who is supposed to have died from a grape-stone having lodged in the larynx (Pliny, l. vii. c. v.), which is opposed to these instances, is probably an example of "poetical justice" and has reference to the previous mode of life said to have been pursued by Anacreon. Retribution, however, did not overtake the rollicking poet until he was 85 years old!

[3] Berlin. klin. Wochenschrift, 1878, No. 18.

[4] See a case in point by Porter, Dub. Med. Press, Feb. 9, 1859.

[5] See the case of a button-mould fixed in the left ventricle of the larynx, and extracted after six weeks by laryngotomy (Pelletan: Clin. Chir., t. i. p. 8. Also an instance by Desault, where a cherry-stone remained in one of the laryngeal ventricles for two years, at the end of which time the patient died from disease of the larynx (Œuvres Chir., t. ii. p. 258). In a case mentioned by Sir Thomas Watson, a piece of gold remained for years in a similar position without detriment to the patient (Pract. of Physic, fifth edition, vol. ii. p. 261).

mation. The position taken up by any foreign body in the larynx can usually be seen on using the laryngoscope.

Diagnosis.—The presence of a foreign body in the larynx can seldom remain for long a matter of doubt. The history of the case is usually clear, and laryngoscopic examination verifies or disproves the statement made by the patient. In the case of children and hysterical females, however, the diagnosis cannot always be arrived at immediately. A child may come home complaining of its throat, and in a short time present symptoms closely resembling croup. The little sufferer has swallowed something used as a plaything, such as a button, small coin, or toy, but either forgets the circumstance or is afraid to tell it. By a careful consideration of all the facts connected with the case, however, and by laryngoscopic examination, the true nature of the affection may generally be brought out. As will be hereafter explained, hysterical persons, suffering from hyperæsthesia or paræsthesia of the larynx, often erroneously fancy that something is sticking in the part. Such cases have generally only to be seen to be recognized.

Prognosis.—Death, of course, sometimes follows immediately on the accident. When this is delayed, there is always great danger as long as the foreign body remains in the larynx or air-passages. A fatal result may occur after a time from two different causes, viz.: either the foreign body may become dislodged, and assuming an altered position, may close the glottis and suffocate the patient in a few minutes ; or the amount of inflammation and tumefaction of the soft parts of the larynx may more gradually lead to the same result. Even after the foreign body has been removed, a cautious prognosis must be given as long as there are any symptoms of local inflammation.

Treatment.—The indication of paramount importance is, of course, to remove the foreign body at the earliest opportunity. Mr. Durham [1] has collected 554 cases of foreign bodies in the air-passages, in 283 of which the substance was extracted by opening the windpipe or otherwise by the medical attendant, whilst in 271 the efforts of nature were left unaided, except in 51 cases where emetics were given. In the first set of cases the deaths amounted to 70 (24.8 per cent.), and in the second set to 115 (42.5 per cent.). Great encouragement is thus given to operative procedures, but it must be taken into consideration in drawing inferences from these tables that death without the expulsion of the foreign body occurred in the cases not operated on 95 times. Doubtless in many of these instances the fatal result was immediate, before surgical aid could be obtained or operative measures adopted. On the other hand, in the cases subjected to operation, the foreign body was probably fixed in a position which admitted of delay, and of course materially lessened the danger of the accident.

If the symptoms are not urgent, a laryngoscopic examination should be made, and the foreign body, if possible, removed with the aid of forceps. The common laryngeal forceps generally answer best, though in the case of children, on account of the small size of the larynx, the tube-forceps are more convenient. But if the patient be found at the last gasp, the first action of the surgeon should be to open the trachea and introduce a canula. Respiration being provided for, the laryngeal mirror may be subsequently used, and the foreign body removed *per vias naturales*. In some cases the foreign body cannot be extracted until it has

[1] Op cit. p. 488.

broken into fragments, as in an instance (hereinafter described) which came under my notice. In some cases, either before or after tracheotomy, according to the urgency of the symptoms, the foreign body may be got rid of by placing the patient head downward and shaking the body. This procedure, which is more likely to answer in the case of smooth and roundish bodies, such as coins, buttons, and stones, is more particularly applicable in the case of foreign bodies lodged below the larynx, and will be found described in detail under Foreign Bodies in the Trachea. Sometimes after reducing the local inflammation by suitable remedies, a foreign body, previously immovably fixed, can be easily extracted. This fact was illustrated by a remarkably successful case of Dr. Whistler's,[1] in which, with the aid of the laryngoscope, he removed a lamella of bone, measuring nearly an inch by three-fourths of an inch, from below the vocal cord six weeks after it had become firmly embedded in the laryngeal tissues. If this method fails, recourse must be had to thyrotomy, practised in the same manner as for the removal of growths from the larynx;[2] but owing to the risk of producing permanent aphonia, the laryngeal cartilages, should, if possible, be left intact. As the operation approaches completion, some caution is necessary, in order to prevent the foreign body slipping down into the trachea after the larynx is laid open. When seen, the object should be grasped firmly with forceps and extracted. Not unfrequently, however, a forcible expiration through the wound expels the foreign body as soon as the windpipe is opened.

Before removing the tracheal canula and closing the opening, great care should be taken to ascertain that the patient can breathe freely through the larynx. After the injured parts have regained their natural condition, an experiment may be made by corking the canula, which may afterward be entirely removed as soon as it becomes evident that the patient is able to breathe freely for an indefinite period through the larynx. The following case is a good illustration of the impaction of a foreign body in the larynx :

CASE OF IMPACTION OF A LAMELLA OF BONE TRANSVERSELY IN THE VENTRICLES.

John B., aged fifty, a laborer, suffering from aphonia, dyspnœa, and dysphagia, was brought to me on September 29, 1866, by Mr. John Cumming. The patient stated that three days previously, whilst taking some soup (made from sheep's head) he suddenly felt choked by something "going the wrong way." He tried to get it up with his fingers, but did not succeed. Subsequently, he vomited violently, and after bringing up large quantities of blood, fell insensible on the floor. On examining him with the laryngoscope, a piece of bone was seen to be lodged horizontally in the larynx, just above the level of the vocal cords, in such a manner that it completely blocked up the anterior third of the laryngeal canal (Fig. A). The bone could not be moved with a laryngeal probe, and after repeated unsuccessful efforts to seize it with forceps, the symptoms being very urgent, tracheotomy was performed. On October 5th Sir William Fergusson attempted, with various instruments, to remove the bone; but it was so impacted that it could not be dislodged. That eminent surgeon

[1] Lancet, Dec. 2, 1876.

[2] See page 237.

recommended that, if after a delay of a few days, the bone was still impacted, the thyroid cartilage should be divided, and the bone removed through the wound. On October 14th I succeeded in passing a blunt hook behind and below the bone, and in this manner brought up a thin lamina of bone about half an inch across in each direction. On the following day a small piece of bone was seen projecting from the right ventricle (Fig. B). After passing an instrument below, and slightly moving the fragment, the patient coughed up a piece of bone, about half an inch long, and a quarter of an inch wide, covered on one side with gristle. On putting the pieces of bone together, they made altogether a lamina three-quarters of an inch long and half an inch wide (Fig. C). This had been impacted horizontally with its long diameter across the larynx in such a manner that about three-eighths of an inch had extended into the right ventricle, and rather less than a quarter of an inch of the bone into the left ventricle ; in this way the bone could not move to the smallest extent either upward or downward. It will be seen therefore that the bone could only be removed by fracturing the portion in one of the ventricles, and that the portion in the right ventricle was separated from the main part by the operation on the 14th. On the 16th the patient was discharged cured. The bone was shown at the Pathological Society, and further details will be found in the *Transactions* (vol. xviii. p. 27 et seq.).

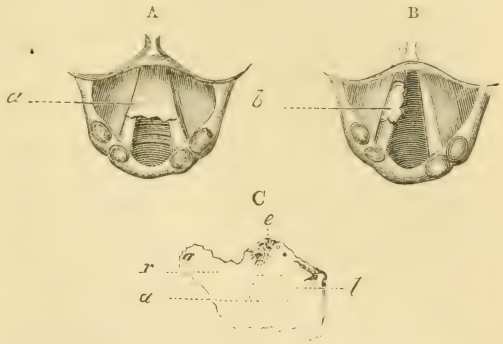

FIG. 87.—A shows the view of the larynx as first seen : *a* is a horizontal lamella of bone, whose outer extremities pass into the ventricles of each side. B shows the view of the larynx, after the bone has been broken, and the central portion and that passing into the left ventricle have been removed : *b* is the fractured edge of the fragment of the bone remaining in the right ventricle. C is the bone put together after removal : *a* corresponds to the portion indicated by the same letter in A ; *r* is the part which passed into the right ventricle ; *l* the portion which rested in the left ventricle, and *e* the surface of the bone that was hidden by the epiglottis.

[NERVO-MUSCULAR AND SENSORY AFFECTIONS OF THE LARYNX.

BEFORE proceeding to describe the various laryngeal neuroses in detail, it is desirable to make a few remarks here on the classification of these important diseases.

Nervous affections of the larynx may be divided primarily into two classes, viz., (1) neuroses of sensation, and (2) neuroses of motion. Concerning the first class, our knowledge is very limited, not only on account of the rarity of the lesion, but also because the subject has hitherto received little attention from laryngoscopists. Disturbances of the motor apparatus of the larynx have, however, been more carefully studied, and

the observations of Ziemssen,[1] Gerhardt,[2] Riegel,[3] and others have provided us with a more complete, though still imperfect, picture of their origin, course, and issue.

There are four kinds of disturbance of the *sensory functions* of the laryngeal mucous membrane, viz., (1) anæsthesia, (2) hyperæsthesia, (3) paræsthesia, and (4) neuralgia or hyperalgesia.

Neuroses of motion may be conveniently divided into the two natural classes, viz., (1) loss of power, or paralysis, and (2) perverted power, or spasm.

Under *loss of power* we have :

1. Paralysis from disease or injury of that portion of the medulla oblongata which constitutes the floor of the fourth ventricle ;
2. Paralysis from disease or injury of the spinal accessory nerve ;
3. Paralysis from disease or injury of the pneumogastric nerve ;
4. Paralysis from disease or injury of the superior laryngeal nerve ;
5. Paralysis from disease or injury of the recurrent laryngeal nerve; and
6. Paralysis of individual muscles, or sets of muscles—a class of affections which, though generally of myopathic nature, can be most conveniently considered in this subdivision.

Under *perverted power* we have :

1. Spasm of the adductors of the vocal cords and its cognate affections ; and
2. Spasm of the tensors of the vocal cords.]

ANÆSTHESIA OF THE LARYNX.

Latin Eq.—Anæsthesia laryngis.
French Eq.—Anesthésie du larynx.
German Eq.—Anæsthesie des Kehlkopfs.
Italian Eq.—Anestesia della laringe.

Definition.—Loss of sensibility of the mucous membrane of the larynx, due to central or peripheral disease of the nervous system.

Etiology.—This condition, as a serious manifestation, appears to be confined to cases of diphtheritic and bulbar paralysis. Chairou[4] remarks that anæsthesia of the epiglottis and larynx is an invariable concomitant of hysteria ; but, although there is sometimes a slightly diminished sensibility of the *pharynx* in these cases, I have never observed that the mucous membrane of the *larynx* was at all obtuse to direct impressions. Romberg[5] states that in severe cases of cholera there is impaired sensibility of the mucous membrane of the larynx.

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[1] Cyclopædia of Medicine, vol. vii. p. 993.

[2] Virchow's Archiv, vol xxi. ; Volkmann's Sammlung Klin. Vorträge, No. 36, 1872. Laryngologische Beiträge, D. Archiv f. Klin. Med., Bd. xi. p. 575, 1873.

[3] Ibid. : Bd. vi. p. 37, 1869 ; Bd. vii. p. 204, 1870 ; and Volkmann's Samm. Klin. Vorträge, No. 95, 1875.

[4] Études Chir. sur l'Hystérie, Paris, 1870.

[5] Hufeland's Journal der pract. Heilkunde, Feb., 1832.

Symptoms.—In some cases the loss of sensation does not reach below the vocal cords, whilst in others the anæsthesia extends to the greater part of the mucous lining of the trachea.[1] The affection varies also in intensity ; sometimes it is so complete that any part of the epiglottis or laryngeal cavity may be touched with a sound without producing any sensation or movement of the larynx ; whilst in other cases it is incomplete, a sensation being experienced, but not giving rise to the reflex act of coughing. The anæsthesia may also be confined to one side, or may be bilateral. Dysphagia often occurs in these cases, food, especially in the liquid form, having a tendency to pass into the windpipe. This phenomenon was formerly supposed to result because the insensible condition of the mucous membrane of the larynx allowed particles to enter the air-passage, but it would appear that the actual cause of the penetration of food, is the associated paralysis of the muscles depressing the epiglottis. The motor phenomena commonly coexisting with anæsthesia will be found described at p. 317.

Prognosis.—Except in cases of bulbar paralysis, laryngeal anæsthesia generally terminates in recovery in a period varying from four to six weeks. It must not be forgotten, however, that in extreme cases, if proper means have not been taken to prevent the passage of food into the windpipe, death is likely to result from pneumonia.

Diagnosis.—In the absence of any obstruction of the pharynx or œsophagus, the tendency of food to pass into the larynx when the patient is swallowing strongly points to the probable existence of anæsthesia, but certainty can only be attained with the laryngeal probe.

Pathology.—All cases of true anæsthesia of the larynx must be due to loss of function of the superior laryngeal nerve, or of certain fibres in the pneumogastric nerve which ultimately form the superior laryngeal nerve, or a minute portion of the nucleus of the pneumogastric nerve must be involved in the floor of the fourth ventricle. The change which takes place in the nerve-structures in diphtheria will be found described at page 114, and in greater detail in my recently published work.[2] The pathology of bulbar paralysis is contained in the ordinary text-books of medicine.

Treatment.—The local application of electricity is the most important remedy in this class of diseases. I formerly only employed faradism, but during the last five years I have, as a rule, used both the galvanic and induced currents. In any case the current should be sufficiently strong to cause discomfort, but not pain. In order to carry out this treatment, either the double laryngeal rheophores (page 186) or my single electrode (page 186) may be used. If the latter instrument is employed the necklet should be worn, so that its metal disk lies over some portion of the course of the superior laryngeal nerve between the greater cornu of the hyoid bone, and the base of the arytenoid cartilage. In either case the instrument may be introduced daily into the larynx, and used six or eight times at a sitting. Whilst the local treatment is being thus pursued, it is also advisable to improve the health of the patient by general tonics, and especially by the administration of strychnine; and if, in swallowing, food enters the larynx, the patient should be fed with the œsophageal tube. In introducing the instrument care should be taken not to pass it into the la-

[1] See Schnitzler: Wiener Med. Presse, Nos. 46 and 48, 1873. See also Leube: D. Arch. f. Klin. Med., Bd. vi. p. 266, 1869; and Acker, Ibid., Bd. xiii. p. 416, 1874.

[2] Diphtheria, 1879, p. 38 et seq.

rynx, an accident which is not unlikely to occur in this class of cases. The tube should therefore be guided down the throat as far as possible by the finger, and when *in situ*, if there be any doubt as to its position, the patient should be desired to produce a vocal sound before any food is injected.

CASES OF ANÆSTHESIA OF THE LARYNX AFTER DIPHTHERIA.

Case 1.—On November 5, 1876, two sisters, suffering from anæsthesia of the larynx, came under my notice. The first case was that of Mrs. W., aged forty-three, who was recovering from diphtheria when I first saw her. Three of her children had been attacked with the disease, and as they were recovering she became affected. When I saw her the pharynx was slightly œdematous and red. There was abundant frothy secretion, but no false membrane, and she was able to swallow with slight difficulty. On November 8th the dysphagia had greatly increased, she became much weaker, and could scarcely stand. In attempting to walk her gait was unsteady, and she once fell down in walking across her room. On November 9th the patient was unable to swallow at all, everything passing into the windpipe, and giving rise to paroxysms of coughing. Her voice was weak and nasal, but distinctly phonetic. The uvula and palate were both completely paralyzed and insensible, and on making a laryngoscopic examination the epiglottis was seen to be slightly inflamed, and retracted against the back of the tongue, so that only its under surface was visible. The vocal cords appeared healthy in color, and their adductive action was normal. On introducing a laryngeal probe into the larynx and touching the epiglottis and vocal cords no effect was produced, but the action of the vocal cords prevented the passage of the sound into the subglottic region. On placing the finger on the crico-thyroid muscle, and directing the patient to speak, the muscle was felt to contract normally.

This patient was fed by means of the œsophageal tube twice a day for a fortnight, when to a great extent she had recovered her power of swallowing; both galvanic and induced currents of electricity were also applied daily for a month to the pharynx and larynx. Strychnia was administered in this case, but after taking $\frac{1}{50}$th of a grain three times a day for two days, toxic effects were produced, and the drug was accordingly discontinued, and quinine prescribed. By the middle of December the general health was greatly improved; the patient had quite recovered her power of walking, but she had occasional trouble in deglutition, and was attacked with paroxysms of choking and coughing during meals. On referring to my note book I find that complete insensibility of the larynx remained for ten days after I had first noticed it. After this it gradually disappeared, but the attacks of choking and violent coughing in swallowing continued some weeks after the larynx had recovered its sensibility to the impression of the laryngeal sound and the epiglottis had regained its power. The voice was still nasal, and there was paresis of the palate on January 1st. The patient left town at this period, and I heard that her voice did not become quite normal till the middle of February.

Case 2.—Miss A., aged forty-one, who had assisted in nursing the children of her sister (the patient whose case has just been recorded), also suffered from an attack of diphtheria. About ten days after recovery difficulty of swallowing came on—the symptoms being very much the same as those described in the case of Mrs. W.—but the voice was completely lost, and she also had dipoplia. Unlike the previous case the power

of the lower extremities was perfect. The palate was found to be paralyzed, and there was complete insensibility of the larynx on introduction of the laryngeal sound. The adductor of the right vocal cord was also paralyzed, and the left cord moved feebly toward the median line. Attempts were made to ascertain whether the crico-thyroid muscle was paralyzed, but the non-action of the adductors rendered it impossible to ascertain laryngoscopically the state of tension of the cords, and the examination of the muscle externally only furnished negative results. This patient was also fed with the œsophageal tube, but did not recover her power of swallowing for more than a month, in spite of the daily use of both forms of electricity, applied directly to the pharynx and larynx, and the administration of strychnia ($\frac{1}{12}$th of a grain) three times a day. The adductors recovered their power and the voice was restored a fortnight before the œsophageal tube could be dispensed with. On the restoration of the voice it was found to have a nasal character, which it continued to possess as long as the patient remained under my observation. The palate also did not completely recover, the words *rub*, *head*, and *egg*, when gently pronounced by the patient, sounding as *rum*, *hen*, and *eng*.

Hyperæsthesia, Paræsthesia, and Neuralgia.

Definition.—Increased or perverted sensibility of the mucous membrane of the larynx, or regularly intermittent pain in that organ unaccompanied by serious structural changes.

Etiology.—Hyperæsthesia is often present when the external parts of the larynx, such as the epiglottis, the ary-epiglottic folds, or the inter-arytenoid fold, are affected by severe inflammation, but this symptom has already been dealt with in describing both acute and chronic laryngitis. Paræsthesia appears in most cases to be the result of some hysterical condition of the system. After a foreign body, temporarily impacted in the larynx, has been extracted, a condition of hyperæsthesia or paræsthesia frequently remains behind for some hours or even days. Preachers and others who are obliged to make much use of their voice are especially liable to suffer from a morbid sensibility of the larynx; in such cases, the local neurosis may be only a sympton of nervous irritability and hypochondriasis, or may be the result of structural changes. True neuralgia of the larynx generally appears to result from cold, or occurs as a sequel to an inflammatory affection. Schnitzler[1] has reported a case of the kind in a man, æt. thirty-six, who had just recovered from an acute attack of angina.

Symptoms.—In hyperæsthesia of the mucous membrane of the larynx the parts are abnormally responsive to the least irritation, so that even coughing and deglutition often occasion disagreeable sensations of various kinds, such as burning, pricking, dryness, constriction, or rawness. In some cases the condition gives rise to a troublesome cough, but true "nervous laryngeal cough" (hereinafter described) usually occurs without any altered sensibility of the larynx. According to Schnitzler,[2] spasm of the muscles of the pharynx and larynx usually accompanies morbid sensibility of those parts, and may even give rise to general convulsions, but

[1] Loc. cit.
[2] Wiener Med. Presse, 1873, pp. 1052 and 1107.

the latter phenomenon is probably due rather to the general state of the nervous system than to the local affection.

In cases of paræsthesia of the larynx, the patient generally complains that some foreign body—which gives the sensation of a hair, a fish-bone, or a rough fragment of any hard substance—is lodged in the throat. As already remarked, such a disturbance of sensation almost always exists for a short time after the removal of a foreign body, but it also often occurs as an idiopathic condition in hysterical girls and women. In such cases the patient is confident of the presence of some offending substance, and applies to the surgeon for its removal; on laryngoscopic examination, however, no vestige of any foreign matter can be found. It occasionally happens that paræsthesia of the larynx of this nature is present in connection with a condition of the mucous membrane which, as far as tactile tests are concerned, appears to be a form of anæsthesia.

True neuralgia of the larynx is apparently very rare, but cases have been reported by Handfield Jones,[1] Clinton Wagner,[2] and Schnitzler.[3] I have met with only thirteen cases: nine of the patients were women and four men. In seven of these cases the pain was on the left side, darting up from the larynx toward the ear; in four it was on the right side and extended in the corresponding direction; and in two cases the pain was on both sides. In all these cases the pain was distinctly intermittent, and in three instances was relieved by pressure. Eight of the patients recovered under the use of quinine and persistent pencilling of the laryngeal mucous membrane with chloroform and morphia. Three derived no benefit from treatment, and two discontinued attendance after a short time, the result being unknown. Even the successful cases, however, proved very obstinate. The ages of the women were as follows:

From 15 to 20 years	1 case.
" 20 to 25 "	5 cases.
" 25 to 30 "	2 "
At 47 years	1 case.

The ages of the male patients were seventeen, nineteen, twenty-three, and twenty-seven.

Prognosis.—A favorable prognosis may generally be given, but it must not be forgotten that disturbances of the sensibility of the laryngeal mucous membrane are often very persistent. Even when consequent on chronic catarrh, the neurosis sometimes continues to trouble the patient long after the catarrhal condition has been removed.

Treatment.—When the laryngeal neurosis, although existing as a local affection *per se*, is associated with an hysterical or hypochondriacal condition, our attention must be mainly directed toward improving the general health. In such cases, change of air, sea bathing, or a course of hydropathic treatment, are most likely to effect a cure of both the constitutional and local disorders. When the malady appears to be purely local, the application of strongly astringent solutions is often of great benefit, but I have found morphia and chloroform, as recommended by Schnitzler, still more useful. Dr. Handfield Jones considers that most cases of laryngeal dysæsthesia are of a rheumatic nature, and recommends

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[1] Med. Times and Gaz., May 2, 1863.
[2] New York Med. Record, Jan. 20, 1875.
[3] Loc. cit.

the administration of iodide of potash. Tobold[1] gives the preference to solution of bromide of potassium. At the same time bromide of potassium should be given internally.

LARYNGEAL PARALYSIS FROM DISEASE OR INJURY OF THE MEDULLA OBLONGATA.

Latin Eq.—Paralysis laryngea ex morbo vel lesione medullæ oblongatæ.
French Eq.—Paralysie laryngée résultant de maladie ou de lésion de la moelle allongée.
German Eq.—Kehlkopflähmung in Folge von Krankheit oder Verletzung der Medulla oblongata.
Italian Eq.—Paralisi laringea da malattia o lesione del midollo allungato.

Definition.—Paralysis of some of the muscles of the larynx, and usually at the same time of some other muscles of the head, face, or extremities, indicative of central disease of the nervous system.

Etiology.—In order to do justice to the etiology of this disease it would be necessary to arrive at the causes of locomotor ataxy,[2] multiple sclerosis, and progressive bulbar paralysis. These affections will be found fully described in the various text-books, and it is only necessary to remark here, that heredity, depressing emotions, excessive mental excitement, and exposure to cold are generally regarded as their chief predisponents. In a considerable proportion of the cases that have come under my notice it will be seen that the patient had suffered from syphilis, and in one instance a gumma was found in the brain.

Symptoms.—In laryngeal affections due to disease of the brain there are generally other symptoms indicative of cerebral disorder. Thus we frequently meet with paralysis of one of the limbs, or loss of power of particular muscles, or one of the special senses may be destroyed. The general symptoms vary according to the particular nucleus which is involved. Sometimes convulsions are present. The laryngeal symptoms also vary greatly; in some cases the nucleus of one recurrent nerve is completely destroyed, and we have loss of power of all the muscles acting on one vocal cord, whilst in others the nuclei of the adductor or abductor filaments may be alone involved; hence, sometimes there is merely hoarseness or loss of voice, whilst in others there is great stridor in breathing.[3]

Pathology.—Neuroses of the larynx dependent on central lesions have their origin in organic disease of the roots of the pneumogastric and spinal accessory nerves in the floor of the fourth ventricle. These paralyses occur, therefore, in connection with brain affections involving the medulla oblongata and pons Varolii, and are occasionally met with in the diseases already referred to under "Etiology." In the only case that has come under my own notice in which a post-mortem examination was made

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[1] Laryngoscopie u. Kehlkopfkrankheiten, 1874, p. 343.

[2] A case in which locomotor ataxy was present has been reported by Professor Charcot (Gazette des Hôpitaux, No. 1, 1879), as an example of "laryngeal crisis," but the use of this term does not appear to possess any particular advantage.

[3] In addition to my own cases, I would refer the reader to the excellent illustrations of the affection published by Pentzoldt (D. Archiv. f. Klin. Med., Bd. xiii. 1874), and Beverley Robinson (American Journ. of Med. Sci., April, 1878).

the disease was of a syphilitic nature; the surface of the medulla oblongata was soft and creamy, but on section the structure appeared healthy. Unfortunately no microscopic examination was made. In Pentzoldt's case the olivary bodies were ill-defined, whilst the anterior pyramids were gray and had a "gelatinous gloss."

Diagnosis.—The most marked characteristic of central paralysis of the laryngeal muscles is the coexistent implication of other nerves—generally of those supplying the palate and tongue, though the facial nerve is sometimes involved.

Prognosis.—The prognosis is generally very unfavorable, but in syphilitic cases the disease may be arrested.

Treatment.—The affection can only be treated symptomatically. If syphilis is present, iodide of potassium should be administered; whilst if the abductors are paralyzed tracheotomy may be necessary.

CASES ILLUSTRATIVE OF PARALYSES FROM DISEASE OF THE MEDULLA OBLONGATA.

Case 1. *Complete Paralysis of the Left Vocal Cord.*—Thomas C., aged fifty, was under the care of Dr. Hughlings Jackson, in the London Hospital, in March, 1864, and I was requested by my colleague to make an examination of the larynx. Dr. Jackson showed me that the patient had paralysis with wasting of the right side of the tongue, the right side of the palate, the right trapezius, and loss of power of the right side of the orbicularis oris. With the laryngoscope, the right vocal cord was seen to maintain the cadaveric position. It is evident that disease of the medulla oblongata alone, and that near the nuclei of the spinal accessory and hypoglossal nerves, could produce these various paralyses. This patient was seen in 1866 and the disease had not then advanced. ("London Hosp. Reports," vol. i. p. 361.)

Case 2. *Complete Paralysis of the Left Vocal Cord.*—In 1865, Z. S., a man aged forty-three, came under my care at the London Hospital, with loss of sensation on the left side of the face, diminished power of taste on the left side of the tongue, paralysis of the left half of the palate, and a shrill voice. About two inches behind the ear and on a level a little below the meatus, was a ragged-edged scar, over a brawny mass running downward, but slanting forward as far as the inferior angle of the lower jaw. The sterno-mastoid appeared to run into the mass in front; and behind the scar and below the general mass the belly of the muscle was hard and prominent. The anterior edge of the trapezius also was hardened and cord-like. With the laryngoscope, the left vocal cord was seen to be immovably fixed in the cadaveric position. There was iritis of the left eye, and besides some opacity of the lower part of the cornea. I transferred the patient to Dr. Hughlings Jackson; and under iodide of potassium and good diet he improved wonderfully. It is true that the paralyses did not pass away, but the general health was apparently restored, and the swelling in the neck reduced and softened.

A few months later, however, the man died from hemiplegia. The membranes at the base of the brain, especially in the course of the fissures, were found to be thickened by a dirty glue-like material. The walls of the left vertebral artery were much increased in bulk, and the right middle cerebral artery entered a tumor about the size of a nut, which on section was soft, and yellowish white—evidently a gumma. A similar

tumor was found extending from a branch of the left middle cerebral artery. The surface of the medulla oblongata was soft and creamy, but on section the structure, which was not subjected to microscopical examination, appeared healthy. On examination of the larynx after death by my cousin, Mr. Frederick M. Mackenzie, the left crico-arytenoideus-posticus was thin, pale in color, and transparent, whilst the right muscle was of a deep red color and twice the thickness of its fellow. The other muscles of the larynx do not appear to have been examined.

For further particulars see "Lond. Hosp. Reports," vol. iv. 1867, page 314 et seq.

Case 3. *Complete Paralysis of the Right Vocal Cord.*—In December, 1868, I was requested by my colleague, Dr. Hughlings Jackson, to see J. G., aged fifty, who was under his care in the London Hospital, suffering from paralysis of several nerves, and from excruciating pains in the head, which scarcely permitted him to get any sleep. The patient's voice was not completely lost, but it was very weak and shrill, and the breathing was slightly stridulous. On laryngoscopic examination, the right vocal cord was seen to be permanently fixed in the cadaveric position. There was slight tumefaction of the right ventricular band, and the side of the epiglottis was a little swollen and pushed toward the left side. "The other defects were," as Dr. Hughlings Jackson described, "all on the right side. The right half of the tongue was greatly wasted, the right half of the palate hung forward a little, and was drawn up to the left, when the patient cried, Oh! and there was nearly complete deafness in the right ear." J. G. had a constant sensation of pain and stiffness at the back of the nose, though nothing could be seen with the rhinoscope. Several times he suffered from severe epistaxis—to the extent of a pint or more on one or two occasions—the blood coming down the nose into the mouth. Externally there was an exceedingly hard tumor, rather longer and narrower than a hen's egg, extending downward behind the angle of the lower jaw, on the right side of the neck, and on the opposite side there was a similar but much smaller tumor. These tumors were first noticed about a year, and the hoarseness about three months, before I saw the patient. Fourteen years previously the patient had undoubtedly suffered from syphilis. Dr. Hughlings Jackson thought the tumors syphilitic. Although the tumors on the right side might possibly have caused pressure on the pneumogastric nerve, the fact that the right half of the tongue was affected clearly points to the central origin of the disease, and there can be little doubt but that Dr. Jackson's opinion "that there was disease of the medulla, near the origin of the spinal accessory, and of several other cranial nerves of the right side," was a correct one.

Case 4. *Bilateral Paralysis of the Abductors.*—J. W., aged forty-four, a drover, was admitted into the Hospital for Diseases of the Throat on March 19, 1868, on account of slight difficulty of breathing; his voice was normal. His history was as follows:—Sixteen months ago he was seized with a general paralysis affecting both extremities on both sides of the body. From this he gradually recovered and had now only weakness in his left arm. On examination the heart and lungs were found to be healthy, but the laryngoscope showed paralysis of the abductors of the vocal cords, which, on inspection, remained only rather more than one-eighth of an inch apart. On phonation they were seen to be properly abducted. This patient only remained under observation for three months, during which time there was neither advance nor improvement in the symptoms.

Case 5. *Bilateral Paralysis of the Abductors.*—William G. F., of West Cowes, Isle of Wight, applied at the Hospital for Diseases of the Throat, July 25, 1868, on account of great difficulty of breathing. He states that he was quite well until three years ago, when he took a severe cold, and has never since been well. In December, 1867, he had an epileptic fit, and subsequently had other attacks. After the last fit, he remained unconscious for some hours. He occasionally passes his motions involuntarily, and his urine frequently oozes away. He states that the difficulty of breathing has been gradually getting worse, and that he now makes so much noise during sleep that passers-by stop under his window, and neighbors in the opposite house are disturbed in their rest.

Present Condition.—The voice is a little husky, but there is no cough. Loud stridor in breathing, greatly increased on the slightest exertion. The larynx is perfectly healthy, with the exception, that on inspiration the vocal cords scarcely move from the median line. No evidence of thoracic disease.

This patient returned to Cowes, where, I am informed by Dr. Hoffmeister, he shortly afterward died.

Case 6. *Bilateral Paralysis of the Abductors.*—James J., aged twenty-five, was admitted into the London Hospital on April 18, 1873. For two years past the patient had been subject to seizures, during which, he says, the power of speech, sight, and motion left him; these were accompanied by nausea and vomiting and by pains in the legs. The patient attributes all the above symptoms to a severe cough, and to violent exertion while playing on the trombone. Fifteen months before he came under notice a peculiarity in his gait was observed, there being an evident loss of co-ordinative muscular power, as in progressive locomotor ataxy. Shortly after this he lost the sight of one eye, and the other eye also became affected a few days later. Five years ago the patient had a primary venereal sore, which was followed by an eruption. *On examination* it was found that both pupils were dilated, and the disks atrophied. Rapid movements of the eyes produced vertigo. The senses of smell and hearing were unimpaired. There was a marked stridor during respiration, and a croupy, inspiratory noise at night. The laryngoscope revealed a partial paralysis of the *crico-arytenoidei postici* muscles, which explained the stridor. There was also a sluggishness in the movements of the muscles of the palate. The administration of iodide of potassium was followed by a speedy improvement in all the symptoms.

Case 7. *Bilateral Paralysis of the Abductors.*—On September 25, 1878, I was called to see Mr. G. J. C., who was suffering from difficulty of breathing. On inquiry, I found that the dyspnœa had been coming on for several years, and that for eight or nine years he had had some weakness, amounting to imperfect paralysis, of the right leg. Whilst sitting in bed there was little stridor, but at my request, he got up, and with some difficulty hobbled across the room with the aid of a stick, when his breathing became decidedly stridulous. He told me that he sometimes made so much noise in his sleep that it awoke him. On examination, the heart and organs of circulation were found to be healthy, but the laryngoscope showed that the vocal cords remained permanently fixed near the median line, being separated, on inspiration, only to the extent of about an eighth of an inch at the posterior portion of the glottis. Mr. C. informed me that he had been seen by Dr. Hughlings Jackson, who had told him that "he had paralysis of some of the muscles of the throat." I recommended tracheotomy, but the patient desired to postpone the opera-

tion. On October 10th he went to stay with a friend near Maidstone, and at night retired to bed in his usual condition. In the morning he was found dead. No post-mortem examination was permitted.

LARYNGEAL PARALYSIS FROM DISEASE OR INJURY OF THE SPINAL ACCESSORY NERVE.

Latin Eq.—Paralysis laryngea ex morbo vel lesione nervi accessorii spinalis.
French Eq.—Paralysie laryngée résultant de maladie ou de lésion du nerf spinal.
German Eq.—Kehlkopflähmung in Folge von Erkrankung oder Verletzung des accessorius Willisii.
Italian Eq.—Paralisi laringea da malattia o lesione del nervo spinale.

The previous division includes paralysis due to injury of the nucleus of the spinal accessory, and under the present head we have to consider paralysis due to disease of either of the spinal accessory nerves in their course.[1] The injury to the nerve generally results from the pressure of a malignant tumor leading to disorganization of the brain. No uncomplicated case has come under my notice in which injury of the accessory branch has been proved to exist, but Türck [2] mentions a case of bilateral compression of this nerve in its passage through the foramen lacerum, owing to cancerous infiltration of the base of the skull. In this case, which occurred in pre-laryngoscopic times (1855), there was hoarseness up to the time of death. Seeligmüller [3] has recorded an excellent example of this rare affection. Schech[4] has also reported a most interesting case in which the accessory nerve, in conjunction with the glosso-pharyngeal, pneumogastric, and hypoglossal nerves, was involved in a sarcomatous tumor at the base of the brain. The symptoms of uncomplicated disease of the accessory nerve are not at present known; whilst treatment can only be expectant, and such as is calculated to promote the euthanasia.

The following case illustrates the affection:

Paralysis of the Accessory and Spinal Branches of the Spinal Accessory Nerve and of other Nerves.—Elizabeth S., aged fifty-one, admitted into the London Hospital, November, 1863, on account of difficulty of swallowing, shortness of breath, and loss of voice. In addition to the symptoms already described, the patient suffered from complete deafness of the right ear and slight deafness on the left side. She had some difficulty in putting out the tongue, and its right side was slightly wasted. The uvula and the walls of the pharynx were quite insensible to irritation. On making a laryngoscopic examination both the vocal cords were seen to remain constantly in the cadaveric position. The sensibility of the

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[1] All the cases that have occurred having been complicated by coexistent lesions of other nerves, it is impossible to treat this affection in the systematic manner which has been carried out with the other neuroses.
[2] Klinik der Kehlkopfkrankheiten, p. 437.
[3] Archiv für Psychiat. u. Nervenkrank., 1872, vol. iii.
[4] Deutsches Archiv für Klin. Medicin, vol. xxiii. Hft. 1 and 2.

larynx was not impaired. There was entire loss of smell—the patient could not distinguish between valerian and peppermint, but when strong ammonia was placed to the nostrils she was able to sneeze. She could not shrug her shoulders. After a few weeks a malignant tumor became apparent in the vault of the pharynx, and the conclusion was arrived at that the growth had involved the origin of the glosso-pharyngeal, spinal accessory, and hypoglossal nerves.

The tumor in the upper part of the pharynx soon after reached the back of the mouth, and became extensively ulcerated and constantly covered with a fetid discharge. The patient, who after a short time was unable to swallow except with the greatest difficulty, became greatly emaciated, and two days before her death had slight convulsions. She ultimately sank in a comatose condition in January, 1864. Unfortunately a post-mortem examination was not permitted, but there can be no doubt that the case was very similar to that which has recently been reported with such admirable detail by Schech.

LARYNGEAL PARALYSIS FROM DISEASE OR INJURY OF THE PNEUMOGASTRIC NERVE.

Latin Eq.—Paralysis laryngea ex morbo vel lesione nervi pneumogastrici.

French Eq.—Paralysie laryngée résultant de maladie ou de lésion du nerf pneumogastrique.

German Eq.—Kehlkopflähmung in Folge von Erkrankung oder Verletzung des N. vagus.

Italian Eq.—Paralisi laringea da malattia o lesione del nervo pneumogastrici.

Definition.—Paralysis of one or both the vocal cords according as the lesion is unilateral or bilateral. In the former case there is dysphonia, in the latter aphonia.

Etiology.—Outside the cranium, as Ziemssen [1] observes, the first point that might be injured is the ganglion of the trunk of the pneumogastric. A complete paralysis of both laryngeal nerves would result from such a lesion, but no example of this condition has as yet been placed on record. Schech [2] has, however, reported a case of post-diphtheritic paralysis, in which some fibres of both pneumogastric nerves, together with its recurrent branches, had undergone fatty degeneration. Below the origin of the pharyngeal and superior laryngeal nerves, the pneumogastric may suffer injury in various ways. I have met with a case in which an aneurism of the carotid compressed the nerve in this situation. The same result may occur in consequence of the presence of bronchocele, or tumors of any kind in the mediastinum. Heller [3] mentions a case in which the trunk of the pneumogastric was the seat of carcinoma; and Cock [4] appears to have injured the nerve in performing pharyngotomy for the re-

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[1] Loc. cit. p. 944.
[2] Loc. cit.
[3] D. Archiv f. Klin. Med., vii. p. 204.
[4] Guy's Hosp. Rep., vol. iv. 3d series, p. 226.

moval of a foreign body. Kappeler[1] gives an instance where the nerve was included in a ligature applied to the carotid artery, and also cites the case in which Billroth excised a piece an inch and a half long from the right vagus.

The *symptoms* of a unilateral lesion of the trunk of the pneumogastric are very similar, so far as the larynx is concerned, to those of injury of the recurrent laryngeal nerves, the sensibility of the larynx being either little disturbed or quickly restored. In Cock's case,[2] the voice, which was previously clear, was altered after the operation to the condition of a "husky whisper." Two years later the patient's singing voice had changed from a "fine tenor into a respectable bass." As the result of experiments by vivisection, it would appear that when a pneumogastric nerve is injured, the opposite nerve, as a rule, suffices to discharge the more important functions previously supplied by both nerves. Hence, although in the first instance, the action of the heart and lungs is temporarily disturbed, these organs generally soon recover. The sensibility of the larynx is also restored after a time, apparently through the nerve influence of the opposite side, and the motor functions of the nerve on the affected side alone permanently suffer.

The *prognosis* is unfavorable as far as regards restoration of function; and *treatment* is generally useless.

Paralysis of the Right Vocal Cord from Wound of the Pneumogastric Nerve; other Nerves also affected.—William C., aged thirty, a coachman, was admitted at the Throat Hospital on October 4, 1870, giving the following history: On his way home late on the night of August 14th he had been suddenly stabbed from behind; the instrument used was a double-edged knife, the blade of which was about four inches in length. One wound had been received in the left side over the sixth rib, and four other wounds had been inflicted in the back of the neck. Profuse hemorrhage followed, and the patient became very weak. The next day there was great difficulty in swallowing, and an inability to properly masticate the food. The patient also felt great heat on the right side of the face, and both eyes were constantly suffused with tears. After fourteen days he went into the country; swallowing became more difficult and his state of health more impaired. About six weeks after the occurrence a swelling took place in the front of the throat. On application, the patient was seen to be a strongly built man, but in a pale, anæmic condition. Four nearly healed wounds were found in the following situations: one just below the prominence of the occiput; a second over the right side of the second cervical vertebra; a third just below, and a quarter of an inch behind the mastoid process. This wound was stated in evidence in the police-court to have been one inch and three-quarters deep. A fourth wound was situated about midway between the second and third. On further examination there was seen to be paralysis of the right side of the tongue, and slight paralysis of the muscles of the upper jaw on the right side. There was diminished sensibility of the right side of the larynx, and loss of power of the abductors and adductors of that side; and there was considerable enlargement of the thyroid body. The patient, who was given mild tonics and generous diet without any special treatment, gradually recovered.

In this case the loss of sensibility of the mucous membrane, the im-

[1] Archiv der Heilkunde, 1864, v. s. 271.

[2] Loc. cit.

paired action of the muscles on the right side of the larynx, and the dysphagia, all pointed to an injury of some fibres of the pneumogastric. The paralysis of the right side of the tongue clearly showed injury of the hypoglossal nerve. It was difficult to account for the apparent paralysis of the temporal and masseter muscles, unless it were that this condition had been caused by some tumefaction and stiffness of the articulation of the jaw.

For further particulars see *Brit. Med. Journ.*, December 24, 1870.

Injury of the Pneumogastric Nerve from Pressure of an Enlarged Gland.—Mrs. C. S. aged thirty-eight, from Taunton, consulted me on May 5, 1874, on account of hoarseness and slight shortness of breath of six years' duration. On making a laryngoscopic examination, the right vocal cord was seen to be immovably fixed in the cadaveric position, but the sensibility of the larynx was not impaired. An enlarged gland, about the size of a pigeon's egg, could be felt deeply situated at the side of the right ala of the thyroid cartilage. Mrs. C. S. stated that she had noticed this swelling shortly before the hoarseness first came on. On deep pressure no other enlarged gland could be detected, nor was there any evidence of any other cause producing pressure on the pneumogastric nerve or its branches. It must, therefore, be inferred that the enlarged gland already described pressed on the pneumogastric nerve in such a way that the fibres of the nerve which ultimately formed the recurrent branch were involved.

Destruction of the Pneumogastric Nerve from Suppuration of an Enlarged Gland.—Miss L., aged nine years, was brought to me in June, 1875, on account of loss of voice. She was a delicate-looking child, and had a scar on the right side of the neck, about one inch below the angle of the jaw, and about half an inch in length. On examination of the larynx, the right vocal cord was seen to be immovably fixed in the cadaveric position. No loss of sensibility. The history of the case was as follows: Two years previously the little girl had suffered from glandular swelling in the neck, which had softened and been opened by a surgeon. Soon after the discharge had taken place it was noticed that the child lost her voice, and the parents attributed this symptom to the surgeon's knife. I explained to the little patient's friends that the matter must have burrowed deeply into the neck and thus reached the pneumogastric nerve, or, at least, certain of its fibres, and that the knife used for the purpose in view could not have inflicted the injury.

LARYNGEAL PARALYSIS FROM DISEASE OR INJURY OF THE SUPERIOR LARYNGEAL NERVE.

Latin Eq.—Paralysis laryngea ex morbo vel lesione nervi superioris laryngei.

French Eq.—Paralysie laryngée résultant de maladie ou de lésion du nerf laryngé supérieur.

German Eq.—Kehlkopflähmung in Folge von Krankheit oder Verletzung des N. laryngeus superior.

Italian Eq.—Paralisi laringea da malattia o lesione del nervo laringeo superiore.

Definition.—Paralysis of the superior laryngeal nerve, giving rise, when complete and bilateral, to anæsthesia of the larynx and loss of power of the crico-thyroid, thyro-epiglottic, and ary-epiglottic muscles.

Etiology.—The only cases in which the existence of this lesion has been hitherto distinguished with any accuracy, have been examples of diphtheria. I have, however, met with one case, which is related at the end of this section, where the affection was due to enlarged glands and inflammation of the areolar tissue beneath the angle of the jaw.

Symptoms.—The phenomena due to anæsthesia of the larynx have been already enumerated (p. 305), and it therefore only remains for us to consider here the symptoms dependent on paralysis of the thyro-epiglottic and aryteno-epiglottic muscles (the depressors of the epiglottis), and of the crico-thyroid muscle. When the two former muscles are paralyzed, the closure of the larynx during deglutition does not take place, the epiglottis remaining erect against the root of the tongue. There is, in consequence, a continued passage of a portion of the matters swallowed, principally fluids, into the laryngeal inlet, and since, owing to the accompanying anæsthesia, the reflex act of coughing does not occur until the foreign substance passes below the level of the vocal cords, some of the food finds its way down the trachea, and an attack of pneumonia is thus likely to be provoked. Complete paralysis of the crico-thyroid muscles is rare, but when present it is easily distinguished. For on directing the patient to produce a vocal sound, and at the same time placing the finger on the outer portion of the crico-thyroid space, the absence of tension on the part of the crico-thyroid muscle can sometimes be perceived. When the affection is bilateral and well marked, the glottis is represented by a wavy line (Fig. 88); there is also not unfrequently a slight depression of the central portion of the vocal cords in inspiration, and a corresponding elevation in expiration and vocalization, and the vocal processes can seldom be seen; when the muscle on one side alone is affected, the corresponding vocal cord remains on a higher level than its fellow.[1]

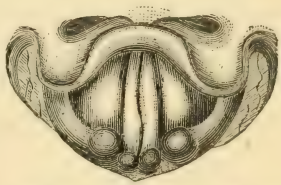

Fig. 88.—Bilateral Paralysis of External Tensors.

Pathology.—Schech's[2] careful experiments have confirmed the views commonly entertained that the superior laryngeal nerve supplies sensation to the larynx above the level of the vocal cords, and motor power to the crico-thyroid muscle, and he has further confirmed the view that the thyro-epiglottic and ary-epiglottic muscles receive their motor supply from the same source. The case of Kappeler[3] (already reported, page 315), in which, after accidental removal of a portion of the right pneumogastric nerve (which, of course, includes the nerve-fibrils ultimately forming the superior laryngeal nerve), the muscles of the epiglottis acted normally, and the sensibility of the larynx remained intact, though there was complete paralysis of the right vocal cord, is probably to be explained by the compensatory action of the left nerve. There is, however, much difficulty in meeting the cases of Türck.[4] That excellent observer has reported several cases of pure paralysis of the recurrent nerve in which there was *atrophy and fatty degeneration of the crico-thyroid muscle*, as well as of the laryngeal muscles supplied by the recurrent, whilst the superior laryngeal nerve appeared quite normal under the microscope.

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[1] Riegel: Volkmann's Samml. Klin. Vorträge, No. 95, 1875.

[2] Zeitschrift f. Biologie, ix., 1873; and Luschka: Der Kehlkopf des Menschen, p. 166, Tübingen, 1871.

[3] Archiv der Heilkunde, 1864, v. s. 271.

[4] Klinik der Kehlkopfkrankheiten, Wien, 1866, p. 436.

Prognosis.—In complete paralysis of both superior laryngeal nerves the patient's condition is attended with considerable danger, but if only one nerve is affected there seems to be little risk. In the former case the patient may either perish from inanition through refusing to take food, or from pneumonia if he continues to swallow aliment in the natural manner. Cases have been reported by Weber,[1] Maingault,[2] Monckton,[3] Ziemssen,[4] and others, in which a fatal termination of paralysis of the throat could only be accounted for by lobular pneumonia, brought about no doubt by the passage of food down the air-tracts.

Diagnosis.—The recognition of this form of laryngeal neurosis can only be accomplished with the laryngeal mirror and probe, and has already been referred to in dealing with anæsthesia of the larynx (page 305), as far as regards the anæsthesia of the mucous membrane and the paralysis of the depressors of the epiglottis.

Treatment.—The management of cases of paralysis of the depressors of the epiglottis with loss of sensation in the mucous membrane, consists mainly in keeping the patient clear of the disastrous consequences which ensue from the passage of food in the air-passages, until the parts affected recover their normal condition. To achieve this object food must be given by means of an œsophageal tube passed beyond the orifice of the larynx. Through this tube any nutritive fluid may be injected, such as milk, beef-tea, chicken-broth, etc. At the same time an attempt must be made to restore the functions of the paralyzed muscles by the use of galvanism and faradism, and by the administration of general tonics. On several occasions I have used strychnia with apparent advantage, and Ziemssen counsels the hypodermic injection of this remedy.

CASE OF INFLAMED CERVICAL GLANDS PRESSING ON THE SUPERIOR LARYNGEAL NERVES.

In May, 1874, H. B., aged thirty-seven, came under my care, at the Hospital for Diseases of the Throat, suffering from inflammation of the *glandulæ concatenatæ* and the adjacent areolar tissue on both sides of the neck. The glands were swollen and inflamed from the back of the neck to the sternum, and at the angle of the jaw the skin was red, hot, and almost erysipelatous in appearance. The patient complained of difficulty of swallowing, liquids constantly "going the wrong way," and he had complete loss of voice. I expected to find considerable inflammation of the internal parts of the throat; but, on laryngoscopic examination, with the exception of some fulness behind the left tonsil, slight congestion of the vocal cords, and an unusually turgid condition of the veins of the pharynx, nothing abnormal was seen. The difficulty of swallowing was considered functional. When, however, the patient paid his next visit, the dysphagia having become worse, a more minute examination of the larynx was made, and it was found that there was complete anæsthesia of its lining membrane. A sound could be applied to any part of the interior of the larynx without producing the slightest cough or irritation. It was also observed that the epiglottis constantly maintained its erect pos-

[1] Virchow's Archiv. Bd. xxv. p. 114, and Bd. xxviii. p. 489.

[2] De la Paralysie Diphthéritique, Paris, 1860.

[3] Second Rep. of Med. Off. of Privy Council, 1860.

[4] Ziemssen and Steffen: Die Krankheiten des Kehlkopfes, reprint from the 2d German edition of Ziemssen's Cyclopædia.

ture, and that the vocal cords, though easily adducted, were not tense. There was no appreciable loss of power of the crico-thyroid muscle, as far as external examination showed. The nerve-symptoms were now attributed to pressure on the superior laryngeal nerve. Poultices were applied to the neck, and the patient was directed to swallow nutritive liquids thickened with corn flour. A few days later a post-pharyngeal abscess was opened on the left side, whilst the swelling on the right side of the neck gradually subsided without suppuration. The patient recovered his power of swallowing on the evening of the day the abscess was opened, and his voice returned a few days later. In this case there is little doubt but that the superior laryngeal nerve was pressed on near its division into the external and internal branches.

(For further illustrations, see the diphtheritic cases reported at pages 306 and 307).

LARYNGEAL PARALYSIS FROM DISEASE OR INJURY OF THE RECURRENT NERVE.

Latin Eq.—Paralysis laryngea ex morbo vel lesione nervi recurrentis.
French Eq.—Paralysie laryngée résultant de maladie ou de lésion du nerf laryngé inférieur.
German Eq.—Kehlkopflähmungen in Folge von Erkrankung oder Verletzung des N. recurrens.
Italian Eq.—Paralisi laringea da malattia o lesione del nervo recorrente.

The disease may be either bilateral or unilateral, and we must consider these two conditions separately.

Bilateral Paralysis.

Definition.—Paralysis of the recurrent laryngeal nerves, causing complete immobility of both vocal cords and loss of voice. When the paralysis is partial, certain fibrils of the nerve alone being implicated, the abductor muscles are generally first affected, and are sometimes the only muscles which suffer.

Etiology.—Cases of bilateral paralysis of the recurrent laryngeal nerves are comparatively rare, though examples have been reported by Ziemssen,[1] Türck,[2] Traube,[3] and others. The paralysis may be due to disease of the medulla, or to compression or destruction of certain fibres of the pneumogastric nerve, or to direct pressure on the recurrent nerves themselves; that is to say, the lesion may be either central or peripheral. The first two conditions have already been considered in previous sections. There remain, therefore, only the local influences.

I have seen one case in which incomplete paralysis was caused by a double aneurism, and have met with several instances where either complete or partial paralysis was brought about by cancer of the œsophagus,

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[1] Loc. cit. p. 950.
[2] Op. cit. p. 428.
[3] Deutsche Klinik, 1860, No. 41, and 1861, No. 27.

and cancer of the thyroid gland; I have likewise seen several cases where the bilateral pressure was caused by a simple fibrous goitre. Goitre is, perhaps, the most frequent cause of this rare condition; it was, probably, the condition in Gerhardt's case,[1] though, as the abductors alone were affected, that case was reported as an example of paralysis of those muscles. The annexed cut (Fig. 89) shows how readily slight enlargement of the tissues in the neighborhood of the œsophagus and thyroid gland may involve both the recurrent nerves. Enlargement, also, of the bronchial glands, or the development of an abundant and dense connective tissue in their neighborhood, occasionally gives rise to pressure on the nerves (see my case hereinafter related, and also Riegel's case,[2] in which the abductor filaments alone suffered). Koch's[3] case is also of a similar kind. Bäumler[4] relates a unique case in which bilateral paralysis of the vocal cords followed a large pericardial exudation in a debilitated syphili-

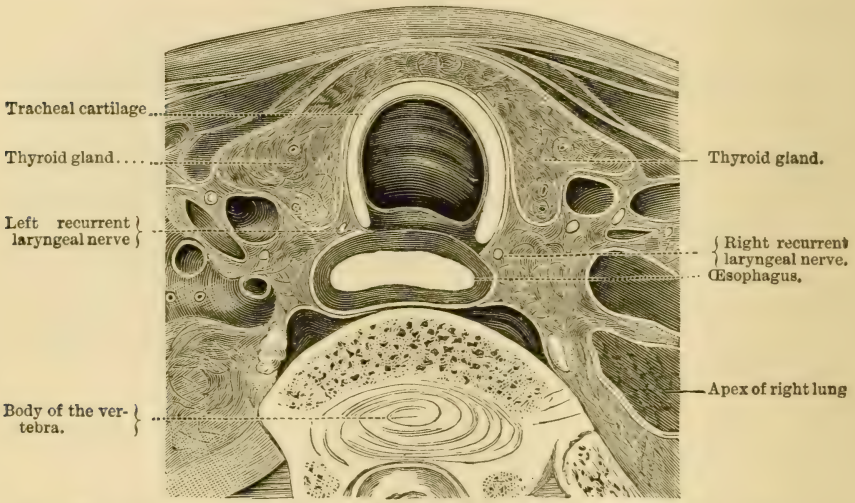

FIG. 89.—Transverse Section of the Neck of a Man Twenty-five Years old, at the Height of the Lower Surface of the First Dorsal Vertebra. (From Ziemssen, after Braune.)

tic subject. The phenomenon appeared to be due to pressure on both recurrent nerves from the crowding together of the soft parts by the pericardial exudation, a greatly enlarged heart, and distention of the right innominate and jugular veins.

Symptoms.—The phenomena attendant on paralysis of the recurrent laryngeal nerves depend altogether on the seat and extent of the lesion. It must not be forgotten that the recurrent nerve consists of a bundle of filaments, which supply directly antagonistic muscles, viz., the abductors and the adductors of the vocal cords. When the nerves are uniformly involved, *i. e.*, when the whole trunks are affected, both the ab- and adductor filaments are paralyzed, and the vocal cords remain in what

[1] Virchow's Archiv, 1863, vol. xxiii. pp. 68 and 269.
[2] Berlin. Klin. Wochenschrift, 1873, Nos. 20, 21, and 27.
[3] Annales des Malad. de l'Oreille, etc., 1878, No. 6.
[4] Deutsches Archiv f. klin. Medicin, 1867, ii. S. 550.

Ziemssen calls "*the cadaveric position*," *i. e.*, in a situation half way between the median position of phonation and the lateral position of deep inspiration, their immobility being very characteristic, and the diagnosis easy and conclusive. *No dyspnœa is present in such cases*,[1] and the voice may be weak or reduced to an almost inaudible whisper. In any case there is constant waste of breath present, and speaking is attended by a great increase in the amount of effort normally required, the excessive size of the glottis necessitating a greater degree of pressure to throw the vocal cords into vibration. The muscles of expiration, especially the abdominal, are therefore unusually strained, discomfort is felt at their thoracic attachments, and the patient quickly becomes exhausted. He cannot cough, expectorate, or speak properly, because in these acts it is necessary to close the glottis, and this he cannot accomplish. On forced inspiration a stridulous sound is often produced, which appears to depend on the arytenoid cartilages, the ary-epiglottic folds, or the flaccid vocal cords being thrown into coarse vibrations.

When the paralysis, whether bilateral or unilateral, is *incomplete*, the symptoms vary according to the degree of pressure on the recurrent nerve, and according to the nerve-filaments which are most compressed. Thus, either the filaments going to the adductors or those supplying the abductors may be principally impinged upon. In the former case the abductor will keep the cord well to the side of the larynx, whilst in the latter the action of the adductors will maintain the cord near the median line. Experience has shown that the abductor filaments are more often pressed on than those going to the adductors. The reason of this is not at all obvious ; it may be that the abductor filaments are more superficially situated than the adductors, or it may be that the adductors receive an increment of nerve-force from the superior laryngeal nerve; the fact that the arytenoideus or central adductor certainly receives some filaments from this nerve, supports the latter view. But whatever the cause may be it is undoubtedly true that pressure on the recurrent nerve, if not complete, is more apt to affect the abductor than the adductor filaments.[2] The vocal symptoms do not depend alone on the relation of the ab- and ad-ductors to one another, for the vocal cord may be either tense or relaxed, according as the crico-thyroid and thyro-arytenoid muscles are stretched or relaxed. Thus, if the tensors are paralyzed at the same time as the abductors the symptoms are likely to be less active (that is, there is likely to be less stridor) than when the abductors are paralyzed, but the tensors retain their vigor.

It occasionally happens that the paralysis is incomplete on one side. Under such circumstances a certain modification takes place in the symptoms, and the patient, instead of being aphonic, is enabled, by a distressing effort, to produce a considerable volume of sound. The tones formed are monotonous and, owing to the impossibility of the vocal cords being closely approximated, of a low register. The coarse vibrations produced by the paralyzed and the paretic cord account for the phenomenon.

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[1] I take this opportunity of acknowledging the error I made in making an opposite statement many years ago (Med. Times and Gaz., April 3, 1869). It will be seen by reference to the case on which I made this erroneous assertion that the paralysis was incomplete, the abductor filaments of the nerve being alone implicated.

[2] The relatively greater disposition to implication of the abductor filaments was illustrated by my cases (Nos. xix. and xx.: Hoarseness and Loss of Voice, etc.), as long ago as 1868, and has since been confirmed by many other cases—especially a case by Schech, loc. cit.

Pathology.—The pathology of these affections has been greatly encroached upon in considering their etiology. As regards their morbid anatomy, however, the changes found in the post-mortem room consist of alterations in the normal condition and structure of the diseased muscles and nerves. The recurrents and their branches are often almost completely atrophied, the proper nerve-substance having disappeared, and the neurilemma alone remaining. In other cases the nerves are found to have undergone fatty degeneration to a greater or less extent. According to Ziemssen, it is sometimes possible to demonstrate, in the case of partial peripheral paralysis, a degeneration limited to a single nerve-fibre. As regards the affected muscles, they also undergo retrograde metamorphosis, and, as a rule, atrophy *pari passu* with the changes in the nerve-structures.

A case has been reported by Dr. George Johnson,[1] and another by Dr. Bäumler,[2] in which pressure on one pneumogastric nerve was accompanied by paralysis not only on the side on which the nerve was pressed upon, but also on the opposite side. In both these cases the abductors were principally affected. Johnson has suggested that there is in these cases a reflex paralysis, the afferent fibres of the nerves carrying back the irritation to the nuclei of the spinal accessory, from which the pneumogastric receives most of its motor fibres. Dr. Lockhart Clark [3] has demonstrated the remarkable decussation of the nuclei of the spinal accessory nerve, and Johnson thinks that this arrangement accounts for pressure of one pneumogastric nerve causing paralysis of the muscles on the opposite side. This explanation has not been generally accepted, and it must be admitted that when one pneumogastric nerve is pressed upon, the muscles on the opposite side are not generally affected, but, on the other hand, appear to compensate to some extent. It is more probable that in such cases as that reported by Dr. Johnson, central disease is set up, and the nuclei of the spinal accessory nerve become actually diseased.

Prognosis.—This will depend mainly on the cause which gives rise to the paralysis, but if the paralysis is complete, or the abductor filaments mainly affected, the local condition is attended with great danger.

Treatment.—This must be directed against the cause of the paralysis. Goitres may be actively treated by appropriate remedies, the progress of aneurisms must, as far as possible, be checked, and the suffering of cancer alleviated ; at the same time the nutrition of the muscles may sometimes be kept up by faradism and galvanism. When the paralysis mainly affects the abductor filaments and there is dangerous dyspnœa, tracheotomy must be performed.

CASES ILLUSTRATING COMPLETE AND PARTIAL BILATERAL PARALYSIS OF THE RECURRENT NERVES.

Case 1. *Complete Paralysis of both Recurrents from Cancer of the Thyroid Gland.*—Mary Ann L., aged fifty-six, was admitted into the Hospital for Diseases of the Throat in November, 1869, suffering from an enlarged thyroid gland, loss of voice, shortness of breath, and violent paroxysms of coughing. On laryngoscopic examination both vocal cords

[1] Transactions of the Roy. Med.-Chir. Soc., vol. lviii. p. 29.
[2] Transactions of Pathological Society, vol. xxiii. p. 66.
[3] Philosoph. Trans., 1868, Part I.

were seen to be fixed in the cadaveric position, being neither abducted in inspiration, nor adducted in vocalization. The patient's general condition was very cachectic, and the neck measured seventeen inches around. The thyroid gland was very hard and nodular, and on the left side the skin was dark and inclined to ulcerate. Ten days later an ulcer was found in this situation, and after repeated hemorrhages the patient died three months after her admission.

On post-mortem examination a cancerous tumor was found completely obliterating both recurrent nerves. On examining the larynx the posterior and lateral crico-arytenoids on both sides were found to be wasted, the transverse striation of these muscles being in parts very imperfect; the arytenoideus proprius alone seemed to be healthy.

Case 2. *Pressure on both Recurrents by Aneurisms, giving rise to Bilateral Paralysis of the Abductors.*—C. J., aged fifty-one, was admitted into the Hospital for Diseases of the Throat on the 15th March, 1869, suffering from dyspnœa, stridulous breathing, and slight spitting of blood. His voice was weak, but phonetic, and he had some difficulty of swallowing. On examination with the laryngoscope, both vocal cords were found to be in a state of adduction, being about $\frac{1}{16}$th of an inch apart; on phonation the vocal cords approximated. On percussion of the chest, dulness was found over the manubrium sterni, extending on the right side to the clavicle, on the left side over one inch of the space between the first and second ribs at its sternal extremity; above, the dulness did not reach quite to the margin of the sternum, and below terminated on a level with the second rib. An aneurism was diagnosed, but the dyspnœa being very severe, and evidently due to nerve pressure, tracheotomy was performed by Mr. Evans on the 27th March. The patient made a good recovery, and left the hospital at the end of April in a feeble condition, wearing the tube, the paralysis of the abductors remaining. A fortnight later he was admitted with violent hæmoptysis, of which he died forty-eight hours afterward. On post-mortem examination two aneurisms were found. One very large, commencing in the ascending aorta, and involving the innominate right subclavian artery, pressed at its upper and outer part, on the right recurrent nerve and slightly on the right pneumogastric nerve. The second smaller aneurism involved the under and posterior surface of the descending portion of the arch of the aorta, and slightly pressed on the left recurrent nerve. On examination of the larynx, the posterior crico-arytenoids on both sides were found to have undergone fatty degeneration, so that there was very little of the true muscular substance remaining. The other muscles of the larynx on both sides were healthy, the striæ being well marked.

Case 3. *Pressure on both Recurrent Nerves by Cancer of the Œsophagus, giving rise to Bilateral Paralysis of the Abductors.*—Thomas B., aged sixty-seven, applied at the Throat Hospital, October, 1870, on account of difficulty of swallowing and shortness of breath. A laryngoscopic examination showed paralysis of the abductors. The adductors appeared to act perfectly, but the mucous membrane of the larynx was a little congested, and the voice was husky. It was found impossible to pass any bougie into the œsophagus, owing to a stricture in the upper third of the passage. This patient died about ten days later. On post-mortem examination the canal of the œsophagus was found reduced to such narrow dimensions that a small probe could only just be passed through it. The walls of the œsophagus and the surrounding tissues were occupied by a cancerous growth, which proved on microscopic examina-

tion to be an epithelioma. The exit of the recurrent nerves could not be traced from the cancerous mass, although they were readily followed into it on each side. The abductor muscles were found to be greatly reduced in size and presented signs of fatty degeneration. The other muscles of the larynx were healthy, with the exception of the left thyro-arytenoid muscle, which showed signs of molecular transformation.

Case 4. *Pressure on both Recurrent Nerves by an Enlarged Thyroid Gland, giving rise to Bilateral Paralysis of the Abductors.*—A. F., aged fifteen, a tall lad, of rather delicate appearance, was admitted into the Throat Hospital, October 1, 1878, suffering from stridulous breathing, which had been coming on for four months. When perfectly quiet he could breathe fairly well, but on the slightest exertion he experienced great dyspnœa, and during sleep made a loud noise in his breathing. On examining the neck a moderate sized, but very hard, bilateral goitre was perceived, and on using the laryngoscope the abductors of the vocal cords were found to be paralyzed on both sides. The adductors did not seem to be at all affected, and the voice was perfectly normal. By varied treatment, extending over several months, the bronchocele was cured, and the action of the vocal cords became natural.

Case 5. *Pressure of an Aneurism on both Recurrents, giving rise to Bilateral Paralysis of the Abductors.*—T. E., aged sixty, was admitted under my care at the Hospital for Diseases of the Throat on November 27, 1876. He was quite well up to six months ago, when he caught cold and experienced shortness of breath and a cough. Five weeks before coming to the hospital he noticed difficulty of swallowing. On laryngoscopic examination the vocal cords were seen, in ordinary inspiration, to remain nearly approximated, though in forced inspiration there was a narrow triangular space between them; on vocalization they did not completely approximate. On examination of the chest, slight pulsation was perceived above and below the right clavicle, and still slighter pulsation in the same situation on the left side. Respiration was everywhere feeble. The action of the heart was irregular, the normal sounds being replaced by murmurs, which were heard very distinctly, not only in the cardiac region, but also above and beyond the right clavicle near the acromion. Aneurism and cardiac hypertrophy were diagnosed. The patient gradually got worse, the difficulty of breathing and swallowing increasing, and rapid wasting taking place. Death occurred soon afterward, and on post-mortem examination there was found to be great hypertrophy of the heart, aneurismal dilatation of the first part of the aorta, chronic pneumonia, and enlargement of the bronchial glands. The last-named were enveloped in abundant firm connective tissue, which compressed both recurrent nerves. The trunks of the pneumogastric nerves were normal. The abductors of the vocal cords were very much wasted in comparison with the other muscles of the larynx, but no microscopic examination was made. (An abstract of this case was published in the "Clin. Soc. Trans.," l. c., by Dr. Semon.)

Unilateral Paralysis.

Etiology.—Paralysis of one of the recurrent laryngeal nerves from local mechanical causes is not uncommon, owing, in a great measure, to the long course pursued by the main trunks of these nerves before dividing into their several branches. The relations of the two nerves are well shown

in the annexed drawing (Fig. 90). The left recurrent, arising deepest in the chest below the arch of the aorta, is especially exposed to pressure by aneurisms, enlarged bronchial glands, and other tumors in the mediastinum. On the other hand, the right recurrent, on account of its lying for a part of its course in close proximity with the apex of the right lung, may be compressed by thickening of the tissues in this situation. Dr. Mandl[1] states that whilst in fifty-two cases where the apex of the right lung alone was affected, fifty of the patients were hoarse, in thirty-two cases where the left apex was affected, only one of the patients was hoarse. Dr. Mandl accounts for this difference by reminding us that whilst the left recurrent nerve winds round the aorta, the right recurrent passes in

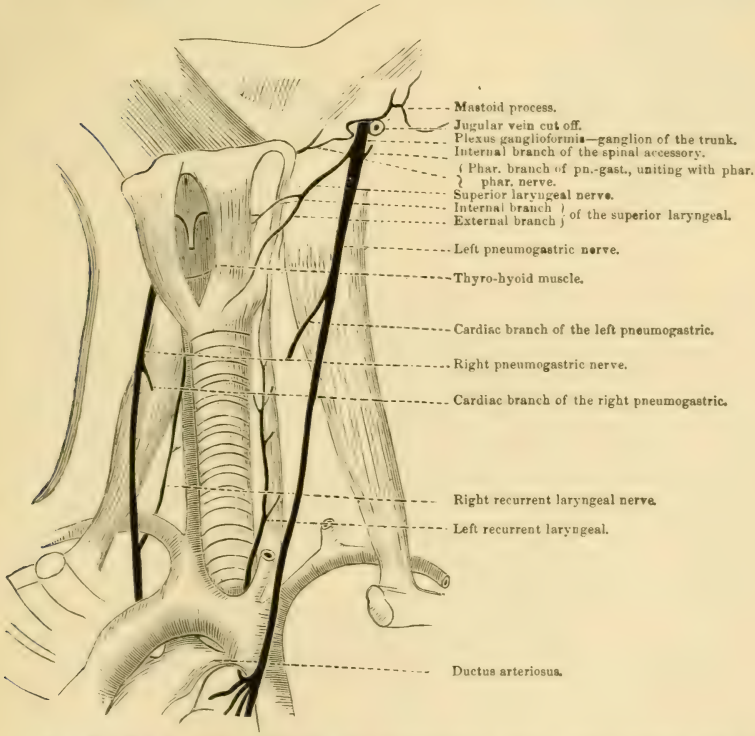
Mastoid process.
Jugular vein cut off.
Plexus ganglioformis—ganglion of the trunk.
Internal branch of the spinal accessory.
Phar. branch of pn.-gast., uniting with phar. br. of glosso-phar. nerve.
Superior laryngeal nerve.
Internal branch of the superior laryngeal.
External branch
Left pneumogastric nerve.
Thyro-hyoid muscle.
Cardiac branch of the left pneumogastric.
Right pneumogastric nerve.
Cardiac branch of the right pneumogastric.
Right recurrent laryngeal nerve.
Left recurrent laryngeal.
Ductus arteriosus.

FIG. 90.—The Laryngeal Branches of the Pneumogastric Nerve. (From Ziemssen, after Henle.)

close contact with the apex of the lung, and is therefore likely to be pressed upon by the morbid deposit, or the pleuritic inflammation at the apex, to which phthisis so often gives rise. I pointed out, however, some years ago,[2] that this enormous preponderance of paralysis of the right vocal cord has not occurred in my experience, and further observations confirm my earlier conclusions. The most common cause of aphonia in the early stages of pulmonary consumption, indeed, is weakness of the expiratory muscles and feeble tension of the vocal cords, and is not of a neurotic

[1] Gazette des Hôpitaux, No. 135, 1862.
[2] Hoarseness and Loss of Voice, p. 17.

character at all. (See Laryngeal Phthisis.) Either nerve may suffer from cancer of the œsophagus, and, perhaps, of all causes, this is the one most frequently in operation. The enlargement of a deep cervical gland, as well as malignant tumors in the neck, also often cause unilateral paralysis, and mediastinal tumors, such as cancers, sarcomas, fibromas, and lymphomas of the bronchial glands, act in the same way.

The *symptoms* of this affection are manifest, for the condition can immediately be recognized by the laryngoscope. When there is complete paralysis of the nerve the affected vocal cord, on attempted phonation, remains in the cadaveric position (see Fig. 92), whilst the healthy cord is adducted to, or even beyond, the median line, one corniculum laryngis often crossing its fellow. Compensation is thus made to some extent for the inaction of the paralyzed cord on the healthy side (see Fig. 94). According to Kappeler,[1] on forcibly striking a high note, the healthy vocal

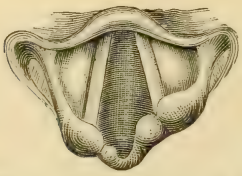

FIG. 91.—Paralysis of the Left Recurrent Nerve as seen in Inspiration.

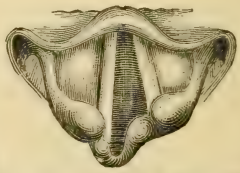

FIG. 92.—Paralysis of the Left Recurrent Nerve as seen in Phonation.

cord may even be dragged over so as to lie on the paralyzed cord. In speaking of bilateral paralysis, it was remarked that in the early stages, and often during the entire period, the abductor is more affected than the adductors of the vocal cords.[2] This observation applies to the affection when it is limited to one side. Hence stridor is more often a symptom than aphonia or dysphonia. The voice of the patient may be completely lost, but it is more often harsh and discordant, and on the slightest strain, when an increased effort is made, it is very liable to break into falsetto tones. This is due to the unequal vibrations of the vocal cords, and to the abnormal way in which they approximate.

Pathology.—The observations made under this head in speaking of the bilateral affection are applicable here.

Prognosis.—The ultimate issue of any case naturally depends on the cause of the paralysis, but the danger of the laryngeal condition depends on whether the paralysis is complete, involving the whole trunk, or whether it is partial, involving the filaments going to the abductor alone. In the latter case there may be dangerous dyspnœa.[3]

Treatment.—It is useless to treat the laryngeal symptoms, except when the abductor alone is affected; then tracheotomy may be required. The cause of the affection must, however, if possible, be grappled with. Cases of this disease are so common, and have so frequently been reported in the medical journals, that I do not think it necessary to append illustrations. One example only is given, partly on account of the obscurity of its etiology, but principally because the illustration shows the crossing of the cornicula in phonation.

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[1] Loc. cit.

[2] See Cases 1 and 2, reported by me in the Med. Times and Gaz., vol. i. p. 356, 1869.

[3] Ibid.

Paralysis of the Left Recurrent Nerve from Unknown Cause.—Sarah F., aged forty-one, admitted into the London Hospital, April 2, 1867, suffering from dysphonia. The hoarseness had existed from childhood, and came on after measles. No evidence of aneurism, thoracic tumor, or glandular enlargement. On laryngoscopic examination, the left vocal cord was seen, in attempted phonation, as well as in quiet respiration, to be immovably fixed in the cadaveric position. (For further particulars see "Hoarseness and Loss of Voice," p. 41.)

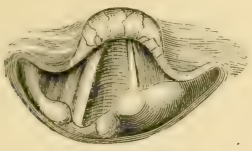

FIG. 93.—Inspiration.

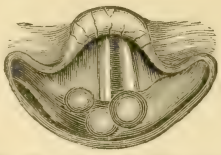

FIG. 94.—Attempted Phonation.

(The right arytenoid cartilage is seen to pass in front of the left, and the right vocal cord to pass beyond the median line to compensate for the inaction of the left cord.)

PARALYSIS OF INDIVIDUAL LARYNGEAL MUSCLES.

It has already been pointed out that individual fibres of the nerves supplying the laryngeal muscles may be implicated either in the medulla, in the main trunks, or the so-called branches, but in addition to these causes of paralysis, loss of power sometimes *appears to arise* from simple myopathic change. Whether the affection under these circumstances is essentially muscular, or whether the nervous system, though apparently healthy, is in reality at fault, has not at present been determined. It is quite possible that microscopic research may at a future period discover histological changes in the nerves which are beyond our present means of detection. On the other hand, there is no doubt that muscles undergo idiopathic changes of a degenerative character quite independently of nerve-lesions. This is constantly noticed in the case of the heart, and Rehn [1] has well observed that the abductors of the vocal cords, the laryngeal muscles which most frequently suffer from degenerative changes, resemble the heart in their remarkable and almost constant action. It may further be stated that some diseases, which are usually regarded as neuropathic, are, nevertheless, considered by some eminent neurologists to be primarily myopathic. Thus Friedreich [2] maintains that in progressive muscular atrophy the primary lesion is in the muscles, and that the affection of the cord is only secondary, the muscular atrophy originating in myositis. Again, in the case of pseudo-hypertrophic muscular paralysis, Dr. Gowers [3] has argued with remarkable ability that there is congenital, nutritive, and formative weakness of the muscle-substance, and that the degeneration in the gray network of the lateral columns is of a secondary character. Further, in some cases of chronic rheumatism, atrophy occurs without any

[1] Deutsches Archiv für Klin. Medicin., vol. xviii.

[2] Ueber progressive Muskelatrophie, Berlin, 1873. See also cases in support of this view by Knoll (Wien. Med. Jahrb., 1872, p. 1), and Malmsten (Schmidt's Jahrb., vol. cxvii. p. 31).

[3] On Pseudo-Hypertrophic Muscular Paralysis, Churchill, 1880.

evidence of nerve-implication. It may also be incidentally pointed out that muscular fatigue from overuse of the laryngeal muscles—especially of the tensors—is one of the most common causes of hoarseness; and that it would certainly be stretching a point to regard these cases of muscular fatigue as neuroses. Taking a broad view of muscular paralysis and atrophy, the case stands thus: Muscular atrophy from disease of the medulla, spinal cord, and motor nerves *is proved;* whilst there is considerable probability that such atrophy *may exist* without any such preceding neurosis. The questions merit elucidation, and the sharply-defined functions of some of the laryngeal muscles and the peculiar arrangements of their nerve-supply make them a favorable subject for further investigation.

Under the heading we are now considering are included only those cases in which there is apparently an entire absence of evidence of nerve-change. It only embraces two classes: (1) Those in which there is distinct muscular atrophy; and (2) those in which the muscles are not thrown into operation from suspended or perverted volition (hysteria). Obviously the two sets of cases are totally distinct, and yet as they do not belong to any of the previous divisions, it is convenient to consider them together. To make further subdivisions would only be to introduce unnecessary complications. Myopathic changes have hitherto been principally observed in connection with bilateral paralysis of the abductors of the vocal cords, but cases occur in which one abductor alone is affected, and others in which, whilst the abductors are principally paralyzed, the action of the adductors is also slightly defective. When both ab- and ad-ductors are paralyzed, the *primâ facie* view, of course, would be in favor of the existence of disease in the recurrent nerve, or in some of the nerve-fibres between the brain and the affected muscles, but there is no reason why the antagonistic muscles themselves should not suffer simultaneously from myopathic change.

BILATERAL PARALYSIS OF THE ABDUCTORS OF THE VOCAL CORDS.

Latin Eq.—Paralysis bilateralis abductorum chordarum vocalium.
French Eq. Paralysie bilatérale des abducteurs des cordes vocales.
German Eq.—Doppelseitige Lähmung der Glottisöffner.
Italian Eq.—Paralisi bilaterale degli abduttori delle corde vocali.

Definition.—Inaction of the abductors on both sides, causing the vocal cords to remain near the median line on attempted inspiration, and giving rise to dyspnœa and stridulous breathing.

History.—The fact that paralysis of the abductors of the vocal cords may give rise to serious dyspnœa was clearly recognized by Etmüller,[1] and the loss of power in these muscles was alleged by Dr. Ley[2] to be the essential cause of laryngismus. Trousseau[3] subsequently referred to this condition as a probable cause of the occasional difficulty of dispensing with the canula after tracheotomy, and it has recently been noticed by

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[1] De Suffocatione convulsiva, vol. ii. p. 226.
[2] Laryngismus Stridulus, London, 1836.
[3] Clinical Medicine, New Syd. Soc. Trans. vol. ii. p. 609.

Professor Gerhardt [1] in a boy on whom that operation had been performed. To the same distinguished physician belongs the honor of first (1863) observing a case of paralysis of the abductors with the laryngoscope (p. 309). His first case was, however, complicated by a double bronchocele and an asymmetrical position of the arytenoid cartilages, circumstances which point to bilateral pressure on the recurrent nerves, and even to direct pressure on the larynx rather than to a simple myopathic affection. In 1866 a case was published by Dr. Hughlings Jackson (see foot-note), in which I described the laryngoscopic appearances. In this instance the affection was strictly confined to the abductor muscles, which were found greatly atrophied after death, whilst the nerve-structures were perfectly normal. Two years later I recorded a second equally typical example, and soon afterward cases were reported by Duranty, Biermer, Pentzoldt, and Feith (see foot-note); in 1872 Riegel reported a very interesting case in which there was bilateral paralysis of the abductor filaments of the recurrent nerves. Shortly afterward, however, this physician published an undoubted case of myopathic paralysis of the abductors in a phthisical patient, in which there was no evidence of nerve-lesion. Many other cases [2] have since been reported, but considering the zeal of

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[1] Handb. d. Kinderkranhk., 2d edition, p 326.

[2] The following is the bibliography of cases up to the present time. (In making this list I have derived much assistance from Professor Burow's excellent paper, referred to below, and I am further indebted to the Professor for several references which he has kindly communicated to me privately; I have also to thank Dr. Pell for full details of his case.) Mackenzie and Jackson: Med. Times and Gazette, December 15, 1866. Mackenzie: Hoarseness, Loss of Voice, etc., p. 34, 1868. Duranty: Diagnostic des paralysies motrices des muscles du larynx, Paris, 1869. Biermer: Volkmann's Sammlung Klin. Vorträge, No. 12, 1870. Pentzoldt: Deutsches Archiv für Klin. Medizin, vol. xiii. p. 107, 1874. Feith: Berliner Klin. Wochenschrift, No. 49, 1874. Tobold: Laryngoskopie u. Kehlkopfkrankheiten, Berlin, 1874. Riegel: Volkmann's Sammlung Klin. Vorträge, No. 95, 1875. Heinze: Archiv der Heilkunde, xvi. p. 77, 1875. Warren: Boston Med. and Surg. Journ., August 31, 1875. Rehn: Deutsches Archiv für Klin. Medizin, vol. xviii., 1876. v. Ziemssen: Ibid., 1876. Böcker: Deutsche Med. Wochenschrift, Nos. 20 and 21, 1877. Klemm: (2) Archiv der Heilkunde, August 1, 1877. Knight: Boston Med. and Surg. Journ., No. 8, 1877. Glynn: The Lancet, September 1, 1877. Smith: American Journal of Med. Sciences, January, 1878. Schreiber: Deutsche Med. Wochenschrift, Nos. 50 and 51, 1878. Semon: Trans. of Clin. Soc., vol. xi., 1878. Smith: Brit. Med. Journ., July 13, 1878. Burow and Meschede: Berliner Klin. Wochenschrift, No. 17, 1878. Lefferts: New York Med. Journ., December, 1878. Fränkel: Berliner Klin. Wochenschrift, No. 10, 1878. Guttmann: Ibid., 1878. Semon: Trans. of Clin. Soc., vol. xii., 1879. Cohen: Diseases of the Throat, New York, 2d edition, p. 654, 1879. Burow: Berlin. Klin. Wochenschrift, Nos. 33 and 34, 1879. Jurasz: Deutsche Med. Wochenschrift, Nos. 14 and 15, 1879. Reichert: Langenbeck's Archiv, Bd. xxiv. Hft. 3, 1879. Browne: Proceedings of Med. Soc. of Lond., vol. iv. p. 223, 1879. Pell: Weekblad van het Nederlandsch tydschrift von Geneskunde, No. 7, 1879. Ott: Prag. Med. Wochenschrift, No. 15, 1879. Whipham: St. George's Hosp. Reports, 1879. Hayes and Semon: Dub. Journ. of Med. Sci., 1880. Woakes: Unpublished case, 1880.

In Dr. Woakes's case the patient was a widow, aged 46, who came under his care at the Throat Hospital, in October, 1878, and on whom tracheotomy was performed in November. The patient had suffered from constitutional syphilis, but did not derive benefit from iodide of potassium, either before or after the operation. With the exception of being obliged to wear a canula, she is now in good health.

In addition to these cases there are several others included in Burow's table and elsewhere reported, which, in my opinion, ought not to be admitted here. Some of these are of a purely mechanical character, whilst others are distinctly due to disease of the medulla, or to pressure on the pneumogastric nerve or its branches. In the mechanical cases, the muscular affection is accidental, whilst in cases of disease of the nerve-centres or afferent nerves, the paralysis ought to be considered under that division of the nervous system which was the *fons et origo mali*. Accordingly, I excluded a

laryngoscopists, and the enormous number of observations which have been made during the last twenty years, the affection must be looked on as rare.

Etiology.—Neuropathic and myopathic cases have been hitherto mixed up together, the etiology of the disease has been rendered very obscure. The affection is much more common in men than women, and in adults than children. The abductors are probably more frequently paralyzed because they are more exposed to accidental injury than any of the other laryngeal muscles. Thus the thyro-arytenoidei are well protected by the thick vocal cords, and the crico-arytenoidei laterales, or adductors, are shielded by the inferior alæ of the thyroid cartilage. The crico-thyroid muscle, it is true, has a very exposed position, but it is protected by the fasciæ and skin of the neck, which afford a better defence than the thin mucous membrane covering the abductors. The arytenoideus, it must be granted, occupies a position corresponding to that of the crico-arytenoidei postici, but the vertical plane in which it lies is considerably in advance of that of the latter muscles, and hence it is much less exposed to the injury which may result from swallowing food containing hard or pointed substances, or drink of too cold, too hot, or too irritating a character. It will be seen that in three of my cases exposure to cold was probably the starting-point of the affection. In one of these cases the patient had suffered from rheumatic fever. Muscular exertion was the apparent cause in one case, whilst in another the paralysis may have had a similar origin, as the patient was a gymnast. In another instance the affection may have been developed through muscular exertion, the subject having been a lawyer constantly engaged in speaking. In many cases the sequence of events is probably as follows: The abductors become accidentally inflamed from cold or from traumatic injury, such as may arise from pressure in swallowing, or the irritating quality of certain kinds of food or drink. The muscles, being injured, ought to be kept perfectly at rest, but every movement of the body requiring the slightest exertion implies a voluntary contraction of the abductors. Even in the comparatively passive act of sighing these muscles are largely called into play. Although the regular action of muscles in a state of health increases their nutrition and adds to their vigor, it will be readily understood that if a muscle is

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case of mine (Growths in the Larynx, p. 177), in which a subglottic growth pressed on the under surface of the vocal cords and prevented their being abducted. I must also reject another of my cases, reported by Dr. Semon (loc. cit.), in consequence of the disease having been proved to be due to pressure on both recurrent nerves. For the same reason I exclude Riegel's first case (Berlin. Klin. Wochenschrift, Nos. 20 and 21, 1872, and No. 7, 1873), and Koch's case (Annales des malad. de l'Oreille, etc., No. 6, 1878); and for the reasons stated in the text, I am also obliged to reject Gerhardt's case. I cannot accept Werner's case (Würzburg. Med. Corresp., No. 10, 1857), on account of its doubtful (pre-laryngoscopic) character, nor Türck's case (Klinik, p. 461), in which the bifurcation of the trachea having been visible, it is scarcely possible to imagine that there could have been any decided narrowing of the glottis. One of Pentzoldt's cases is rejected because it appears to belong to the same category as several of my cases related under the heading of Paralysis from Disease of the Medulla (p. 310), and Beverley Robinson's case, as already pointed out (p. 309, foot-note) belongs to the same subdivision. Martel's case (Annales des maladies de l'Oreille, etc., vol. v. No. 4, p. 200), is excluded on account of its unsatisfactory character and insufficient detail. It is highly probable that even in my table (reduced as it is when compared with that of Burow), some cases are included in which a nerve-lesion actually existed, and which therefore ought properly to be placed in one of the preceding categories. Thus there are several cases in which no post-mortem examination was made, and in which had such a test been possible the classification might have been different.

injured, its action will then bring about pathological changes of a degenerative character ; and this is probably what frequently occurs in connection with the crico-arytenoidei postici. In Ott's [1] case a piece of meat was accidentally impacted at the orifice of the œsophagus, where it pressed on the abductors for twenty-four hours ; and the accident gave rise to the train of phenomena such as have just been described. So gross and palpable an illustration of the starting-point of the affection has not been noticed in any other case, but it is highly probable that in other instances slighter injuries, perhaps not noticed at the time even by the patient, have been the initial events in the series of morbid changes. In some of the reported cases the disease has undoubtedly been due to syphilis—probably to a gummatous deposit in the muscles ; whilst in a few it has been of an hysterical character.

Symptoms.—When a patient has a normal, or almost normal, voice, with freedom of expiration, but great inspiratory dyspnœa, much increased on the slightest exertion, and accompanied with great stridor in sleep, the disease must be suspected. With the laryngoscope the condition is very apparent, for on inspiration, instead of the vocal cords being abducted from the median line, they remain nearly approximated, the opening of the glottis forming a very acute isosceles triangle. The aperture may vary from a line to two lines or more. In forced inspiration the opening generally becomes smaller, and in forced expiration larger; but this is not invariably the case. In some instances the paralysis is partial ; the vocal cords, on inspiration, remaining approximated in their anterior three-fourths, but separating posteriorly, and leaving a small equilateral triangle. Dr. Semon [2] suggests that this peculiarity is probably due to the internal fibres of the abductors maintaining their physiological activity, whilst the external ones are paralyzed. Sometimes one abductor is more affected than the other, or the affection, originally unilateral, may become bilateral.[3] The vocal cords are sometimes slightly congested, but they are often perfectly healthy in color. The voice is not generally much affected, but it may be slightly hoarse. If the patient does not move at all, the respiration may be little affected, but the least exertion brings on dyspnœa and stridulous breathing, with the rapid up and down movements of the larynx which characterize laryngeal obstruction; during sleep the respiration is almost invariably accompanied with loud stridor. The condition is in itself apt to produce constitutional symptoms, such as wasting and febrile excitement, and it is sometimes accompanied by paralysis of other parts. In children it produces symptoms not unlike laryngismus stridulus, and Dr. Ley [4] considered that laryngismus was always of a paralytic nature, but this was an error, as will be hereinafter shown. (See Spasm of the Glottis.)

Diagnosis.—The recognition of this affection is usually very easy, but spasm of the abductors of the vocal cords produces symptoms which to some extent resemble it. In cases of spasm, however, the vocal cords are constantly varying in the degree of adduction, whilst when paralysis is present the cords are quite immobile. Spasm, moreover, very rarely lasts

[1] Loc. cit.

[2] Brit. Med. Jour., May 24, 1879. See also Rühlmann : Untersuchungen über das Zusammenwirken der Muskeln bei einigen häufiger vorkommen den Kehlkopfstellungen. Sitzungsberichte der k. k. Academie der Wissenschaften. Wien, 1874, vol. lxix. 1–5 Heft.

[3] See a case reported by Cohen : Diseases of the Throat, 2d edition, p. 654.

[4] An Essay on Laryngismus Stridulus, London, 1863.

long, and, instead of being increased in sleep, is generally relieved during a state of unconsciousness. These circumstances at once differentiate the two conditions. Mechanical causes may, however, sometimes lead to an erroneous diagnosis. Thus in a case under my care all the symptoms of paralysis of the abductors were produced by a subglottic growth. The case, indeed, was wrongly diagnosed to be one of paralysis of the abductors, and it was only after tracheotomy had been performed, that the growth was discovered. Such rare affections as anchylosis and growing together of the arytenoid cartilages may also simulate paralysis,[1] and, indeed, the disuse of the muscles from these causes may lead to their atrophy. Another source of error arises from the fact that in some persons, especially those of a nervous and hysterical temperament, when their attention is directed to the point, forced inspiration gives rise to approximation of the vocal cords, instead of its causing their separation. This source of fallacy is overcome by keeping the mirror for some time in the throat and allowing the patient to breathe naturally; the normal action of the cords will then be seen.

Pathology.—In three cases seen by me during life, changes were found in the muscles after death, whilst the structure of the nerves and brain was perfectly healthy. In one case the abductors were pale, thin, and atrophied; in another instance one abductor showed signs of fatty degeneration, its fellow being apparently normal; whilst in the third case there was very little of the muscular structure remaining, the few fibres that were left being bathed in pus. In Riegel's case of true myopathic paralysis, "the posterior crico-arytenoidei muscles were of most striking, almost white, sinewy appearance, showing hardly a trace of muscular tissue, while all the other laryngeal muscles seemed normal. On microscopic examination the former showed much connective tissue lying between the muscular bundles, which were still preserved, but which revealed indistinct transverse striations and granular cloudiness."

Prognosis.—The prognosis is generally very serious, as it is only in cases of hysteria or syphilis that any other treatment than tracheotomy can be relied upon. If this operation, however, is performed in due time there is no reason why the patient should not remain well for many years. One of my patients has worn a tracheal canula for twelve years, and, with this exception, is in perfect health. In dealing with this affection it must not be forgotten that continuous narrowing of the glottis is likely to lead to serious disturbance of many important organs. Thus the interchange of gases in the lungs is retarded, the pulmonary circulation impeded, and blood driven back to the right side of the heart. It is unnecessary to dwell on the well-known structural changes which this state of things implies. Attention, however, must be called to the fact that the obstructed respiration it also likely to interfere with the cerebral circulation and to give rise to organic disease of the brain; it is quite possible that in some cases, where the paralysis of the abductors appeared to be due to a lesion of the medulla, the central affection was the final feature in the train of phenomena here indicated.

Treatment.—Whether the paralysis of the abductors constitutes the disease itself, or whether, as in the cases reported in previous sections, it is merely a symptom of a diseased condition on the part of some portion of the nervous system, "the operation of tracheotomy should be performed without delay to save the patient from suffocation." Such were

[1] See Sidlo's case, p. 293.

the words I employed in describing this disease in 1868,[1] and I have little to alter. The fact, however, that a few cases have been reported in which recovery took place, in consequence of the disease having been due to hysteria, syphilis, or catarrh, shows that it is not absolutely necessary to open the windpipe in every instance. The proper line of action has, indeed, been well laid down by Dr. Semon, who remarks[2] that, unless *objective widening of the glottis* be obtained by treatment *within a short time*, tracheotomy ought to be performed without delay. It would appear that that operation is more likely to be required in the purely myopathic cases, than in those in which the muscular change is of a secondary nature. Thus, in my own experience, out of eight cases of myopathic paralysis tracheotomy was necessary four times, whereas in four cases in which the atrophy was due to central disease, the trachea was not once opened, and in four cases in which the atrophy was due to pressure on both recurrent nerves tracheotomy was only once performed. This difference may perhaps be due to the adductors being often slightly affected in cases of nervous origin, whilst in the purely myopathic cases, the affection being generally limited to the abductors, the dyspnœa is more extreme. In two or three of my neurotic cases, however, it must be admitted that the patients died through their unwillingness to submit to tracheotomy. Out of thirty-four cases collected by Burow,[3] tracheotomy was performed seventeen times, and out of six cases occurring in the practice of Tobold[4] the trachea was thrice opened. In neither of these series of cases are the etiological features considered in reference to the subject of tracheotomy.

In slight cases, or in severe ones, after tracheotomy has been practised, both constitutional and local treatment may be tried. Strychnine may be employed hypodermically ($\frac{1}{50}$th of a grain once or twice a day), and electricity, both in the form of faradism and galvanism, may be used with the aid of my abductor electrode (page 186, Fig. 40, *g*). These agents are, however, seldom of any avail. The appropriate remedies for hysteria, catarrh, and syphilis, must be employed where either of these affections is the cause of the paralysis.

CASES ILLUSTRATIVE OF BILATERAL PARALYSIS OF THE ABDUCTORS.

In addition to the following eight cases, I have reported four others under "Disease of the Medulla" (page 310 et seq.), and four under "Bilateral Paralysis of the Recurrents" (page 322 et seq.), making altogether sixteen cases of bilateral paralysis of the abductors in my own practice.

Case 1.—T. T., aged thirty-five, was admitted into the London Hospital, under the care of Dr. Hughlings Jackson, December 5, 1864, on account of great difficulty of breathing. The thorax appeared of natural size and capacity, and was normally resonant; the respiratory murmur was distinct, and heart-sounds healthy. Each inspiration was accomplished with great difficulty, and attended by a crowing and croaking noise; expiration was normal. Two years previously, after a great muscular effort, sudden difficulty of breathing, with a noise on inspiration. This had remained more or less ever since, being much increased by exertion, and

[1] Hoarseness and Loss of Voice, etc., p. 33.
[2] Trans. Clin. Soc., 1879, vol. xii.
[3] Loc. cit.
[4] Op. cit.

when in a reclining posture. Six months before coming under treatment the patient had been seized with giddiness, and had fallen down without becoming quite insensible. For about a week after this he had slight weakness and numbness in the left leg. Dr. Hughlings Jackson was kind enough to ask me to see the case, and on examination with the laryngoscope I found the following: *On Inspiration.*—At its commencement, the vocal cords are separated to the extent of the rim of a sixpence; at its conclusion, they are approximated. *In Expiration.*—During the normal effort the vocal cords remain approximated; if it is forced, they separate to the extent of the rim of a penny. *Vocalization* is not materially affected as the cords always remain in the position suitable for the production of sound. There is no organic disease of the larynx, that is to say, there is no tumor, ulceration, or cicatrix to interfere with the action of the cords. The patient continued to grow worse, and on December 23d laryngotomy was performed, but the man only survived a few hours.

At the post-mortem examination, conducted by Mr. Rivington, it was found that the cords were closely approximated. The mucous membrane of the glottis was perfectly sound. Dissection of the pneumogastric nerves, and of their superior and inferior laryngeal branches, failed to throw any light on the case, for they showed no irritation, pressure, or disease. The lateral crico-arytenoid and posterior crico-arytenoid muscles were carefully examined. The former were quite healthy, but the latter were pale, thin, and atrophied. An ordinary examination of the brain failed to reveal any alteration in its tissues. At the time I agreed with Dr. Hughlings Jackson in regarding this as a case of central disease—though there were no physical evidences of such disease—but further experience induces me to consider this view as incorrect.[1]

Case 2.—Judge S., aged sixty-one, came over from America in 1866 to consult me on account of great shortness of breath and slight hoarseness. He stated that for thirty years his voice had been weak, but that fifteen years ago, after delivering a charge of several hours' duration, he had experienced a sudden and severe spasm in the throat, from which, however, he recovered in a few hours. Since that time he had occasionally suffered from similar, but milder, attacks of the same sort. During the last seven or eight years his voice had become weak, and latterly, on the least exertion, especially talking or going upstairs, he had made a great noise in breathing. During sleep the noise (stridor) was so loud that it disturbed people in the adjoining rooms. At meals it often happened that "things seemed to go the wrong way," and then he had violent fits of coughing. All the symptoms had become considerably aggravated within the last five or six months, and within the last eight or nine weeks he had been troubled with a frequent croupy cough and slight expectoration, the latter occurring especially in the morning. Objectively the patient appeared weak and feeble, but, being a man of great natural energy, he could still endure a considerable amount of fatigue. He was thin and had a yellow complexion, resembling that seen in cases of malignant disease. There was no pain nor other symptoms of paralysis beyond those found in the larynx. Inspection of this part with the laryngoscope showed that on inspiration the vocal cords were scarcely at all abducted from the median line, the space between them not being more than one-sixteenth of an inch. In forced expiration the aperture appeared to be about one-eighth of an inch wide. In phonation the vocal cords, which were of a pearly-

[1] For further details, see Medical Times and Gazette, Dec. 15, 1866, p. 638.

white color, seemed to approximate. The appearances are portrayed in the annexed cuts. The most careful examination of the chest failed to detect any trace of disease in the thoracic organs. I recommended tracheotomy, but the patient would not submit to that operation, and the treatment was confined to the use of stimulating inhalations, an iron tonic, and cod-liver oil. He went to pass the winter in Italy, but more than a year later I again saw this patient, and found him wearing a canula. It appeared that he had taken cold in crossing the Alps, and was compelled to have tracheotomy performed at Geneva. His general condition was greatly improved, and there seemed to be rather more separation between

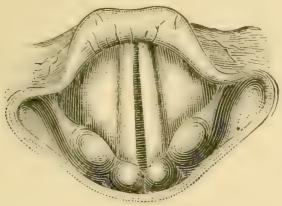

FIG. 95.

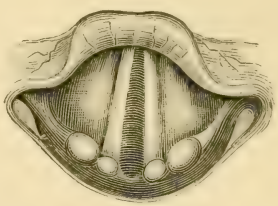

FIG. 96.

Paralysis of the Abductors; Fig. 95 shows the glottis in inspiration; Fig. 96 in forced expiration.

the cords on inspiration. He of course continued to wear the canula. This gentleman presided at a large public dinner at Rochester, U. S., in the year 1878. He was quite well, though still obliged to wear the tracheal canula.

CASE 3.[1]—Charles E., aged thirty-four, a gymnast, was admitted into the Hospital for Diseases of the Throat, under my care, on the 22d November, 1876. He complained of constant difficulty of breathing, which was frequently much increased without any assignable cause. Eighteen years ago he had primary syphilis, but never had any secondary symptoms. Eight months ago he awoke in the morning with great difficulty of breathing, and had since frequently been attacked in a similar way in the daytime; he had never previously been short of breath except under mental excitement. The patient now suffers from marked dyspnœa on inspiration, but his voice was normal; lungs and heart healthy. On laryngoscopic examination it was seen that the vocal cords were scarcely at all abducted on attempted inspiration, but remained near the median line; on phonation the vocal cords were properly adducted. At night his inspiration was attended with such a loud howling noise that it was heard all over the hospital. Tracheotomy was performed, but the patient died eight days afterward from pneumonia. On making a post-mortem examination, the bases of both lungs were found to be hepatized. The mucous membrane lining the bronchi and trachea was very much congested. The heart and large vessels proceeding from it were healthy. The pneumogastric, superior laryngeal, and recurrent nerves were everywhere intact. On examining the muscles of the larynx, the crico-arytenoidei postici were found to have undergone degeneration, their numerous fasciculi showing no trace of striation. In the right muscle numerous fat globules were found, but

[1] In order to avoid any confusion in statistics—especially the double enumeration of cases—I may remark that Cases 3, 4, 5, and 7 in this section were reported in abstract in The Clin. Soc. Trans., 1878, by Dr. Semon, at that time acting as my Clinical Assistant.

in the left there was no evidence of oily matter; the other muscles were healthy. The post-mortem was conducted at the patient's residence, and no examination of the brain was permitted.

Case 4.—G. S., aged thirty, clerk, was admitted at the Hospital for Diseases of the Throat, February 2, 1877; his history was as follows: About two years ago, on waking one morning, he found himself quite blind; he immediately went to a hospital, and at the end of two months quite suddenly recovered his sight. He only remained well, however, for three or four days, when he again became blind. He then went to another hospital, and remained in attendance for a year, but did not receive any benefit. He was told that his complaint was neuritis. He then placed himself under the care of Mr. Liebreich, at St. Thomas's Hospital, when he gradually improved, and ceased treatment in 1876. Soon after he began to suffer from attacks of vomiting, which often continued for three days and nights at a time, and he was also subject to constant headache and giddiness. Three months ago slight dysphagia set in, without any assignable cause; the voice remained normal. It was principally on account of difficulty of breathing, which was daily getting worse, that he came to the hospital. On examination all the organs were found to be healthy, though the circulation was slow (pulse sixty-four, and very weak); over the right carotid there was a systolic bruit, and a diastolic sound. On laryngoscopic examination the vocal cords were seen to remain near the median line, about one-eighth of an inch apart on inspiration. On phonation they were not completely adducted to the median line. Bromide of potassium was first ordered, and after a short time a mixture containing quinine and iron was given. The patient gradually improved, and at the end of six months the condition of the larynx was normal.

Case 5.—J. S., aged sixty-one, was admitted into the Hospital for Diseases of the Throat, April 5, 1877. About two years previously he had taken cold and was attacked with hoarseness and sore throat. This became gradually worse, although from time to time there were slight remissions. Eight months ago slight difficulty of breathing and a fatiguing cough accompanied profuse expectoration. From the commencement he had suffered from substernal pains and palpitation of the heart. Ten years previously he had had an attack of rheumatic fever. On examination the heart and lungs were found to be healthy. A laryngoscopic examination showed paralysis of both abductors, whilst the adductors were only very slightly affected. The patient had slight difficulty of swallowing. Remedial measures failing to benefit the patient, tracheotomy was performed by Dr. Semon, and the patient left the hospital, June 23d, wearing the canula. After some months the patient allowed the tube to be displaced, and not applying to the hospital for four or five days, it was found impossible to replace the tube without doing a second operation. This the patient refused to permit. He stated that he was much better, but a laryngoscopic examination did not show any material improvement. He has not since been heard of.

Case 6.—In September, 1877, I was requested by Mr. Roberts, of St. John's Wood, to see Mrs. W., aged forty-three, who was suffering from great dyspnœa and stridulous breathing. She stated that she enjoyed good health until the year previously, when she began to notice difficulty in breathing in going upstairs. This gradually increased, until the noise in breathing became so loud that it was heard all over the house. During sleep this was greatly intensified. On examining the chest, there was no evidence of any pulmonary or cardiac disease, nor any sign of aneurism.

On laryngoscopic examination, the vocal cords were seen, on inspiration, to be nearly approximated. There was scarcely any congestion of the mucous membrane, and the general configuration of the larynx was perfectly normal. I recommended tracheotomy, but it was not agreed to by the patient. A year later I heard, accidentally, that this lady was occupying some temporary apartments in my neighborhood, and that her loud breathing at night caused her to be a nuisance to all the other lodgers in the house.

Case 7.—James H., aged forty, admitted into the Throat Hospital under my care, January, 1878, suffering from great dyspnœa. On laryngoscopic examination there was seen to be paralysis of the abductors and slight œdema over the arytenoid cartilages. The dyspnœa was so extreme, however, that I requested my clinical assistant, Dr. Semon, to perform tracheotomy at once. The patient, who rapidly became asphyxiated, died two minutes after the operation was performed, and artificial respiration did not succeed in restoring life. It may be mentioned that no anæsthetics were administered, and that there was no hemorrhage. On post-mortem examination all the organs of the body were quite healthy, but an abscess was found in the posterior wall of the cricoid cartilage, which had caused atrophy of both abductors, and disintegration of the nerve-fibres in the immediate proximity of the muscle. In this case the primary lesion was no doubt the abscess, but whether the atrophy of the muscles was entirely due to direct pressure of the abscess, or whether it was caused in part through the nerve-supply being to some extent cut off by the pressure of the abscess on the nerve-fibres in close proximity to the muscle, it is impossible to say. It was subsequently ascertained that the disease came on suddenly twenty-one months ago, after exposure to cold, and the dyspnœa had increased steadily for thirteen months, and to a much greater extent during the last eight months. In the complete absence of any evidence of syphilis or phthisis, the case may be regarded as one of idiopathic perichondrial abscess.

Case 8.—Louisa O., aged twenty-nine, was sent to me by Mr. Charles Hurford, of the Caledonian Road, on April 7, 1879. She has been losing flesh for three years, but a year ago first noticed that her breathing was difficult and noisy, coming on after exposure to cold at night. She had been seen by several surgeons, but nothing has given her any relief, and during the last few weeks she has been getting much weaker. On laryngoscopic examination, it was seen that on inspiration the vocal cords scarcely moved from their median position.

Paralysis of One Abductor.[1]

Definition.—Inaction of the abductor on one side, causing the corresponding vocal cord to remain near the median line on inspiration, and giving rise to more or less dyspnœa and stridulous breathing.

Etiology.—The affection sometimes results from catarrhal inflammation, and I once saw it caused by injury to the muscle from the accidental impaction for two days of some false teeth. I have seen two cases (hereinafter related) in which syphilis was the cause of the paralysis.

[1] The cases in which this condition arises from pressure on the abductor fibres of one of the recurrent nerves have already been described (p. 326).

Symptoms.—The condition can be readily recognized with the aid of the laryngoscope, for on directing the patient to inspire the affected cord is not abducted from the median line. Stridulous breathing and dyspnœa ensue on exertion, but, as might be expected, the symptoms are not so severe as when both cords are affected. The voice is not generally altered unless there is an accidental congestion.

Diagnosis.—The position of the affected cord on inspiration at once establishes the nature of the affection, but it is often impossible to tell during life whether the affection is myopathic or due to nerve-pressure.

Prognosis.—The prospects of the patient in relation to restoration of function depend on the cause of the paralysis and its duration. If there is reason to suppose that the muscular fibres are actually destroyed, the case is, of course, hopeless. As a rule, a cautious prognosis should be given in cases of long standing; and it must not be forgotten that tracheotomy may be required.

Treatment.—In recent cases soothing treatment should be carried out by means of warm inhalations, and, when the local inflammation has passed away, faradism and galvanism may be carried out with my "abductor electrode," whilst in syphilitic cases iodide of potassium should be given. The simple inflammatory cases generally terminate favorably.

CASES ILLUSTRATING PARALYSIS OF ONE ABDUCTOR.

C. H., a man, aged fifty-three, admitted into the Throat Hospital, July 1, 1871, suffering from slight dyspnœa, which he stated commenced three months previously. The larynx showed unmistakable signs of old syphilis, and the abductor on the left side was paralyzed. Under a course of iodide of potassium the action of the abductor became normal at the end of three weeks.

S. E., a woman, aged forty-one, admitted into the Throat Hospital, January, 1874, complaining of shortness of breath. She had a large cicatrix in the pharynx, and the edge of the epiglottis on the left side was destroyed. In vocalization the right vocal cord was normally adducted, but on inspiration it remained about one-eighth of an inch from the median line. The action of the left vocal cord was perfect. The color of both vocal cords was healthy. The voice was natural. The patient had suffered from syphilis ten years ago. Treatment of various kinds proved quite unavailing.

BILATERAL PARALYSIS OF THE ADDUCTORS OF THE VOCAL CORDS.

(Synonyms: Functional Aphonia. Hysterical Aphonia. Aphonia. Nervous Aphonia.)

Latin Eq.—Paralysis bilateralis adductorum chordarum vocalium.
French Eq.—Paralysie bilatérale des adducteurs des cordes vocales.
German Eq.—Doppelseitige Lähmung der Glottisschliesser.
Italian Eq.—Paralisi bilaterale degli adduttori delle corde vocali.

Definition.—Inaction of the adductors on both sides resulting in the non-approximation of the vocal cords on attempted phonation, and consequently giving rise to loss of voice.

Etiology.—The most common cause of this affection is hysteria, and hence it is much more common in women than men, and is more often met with among young women than old ones. Children rarely suffer from this form of paralysis, but I have met with it at eight years and ten years of age—in both instances in girls. Professor Gerhardt [1] opposes the view that hysterical patients do not wish to speak aloud for fear of pain and inconvenience, on the grounds that, paralysis is not unfrequently more marked on one side than on the other, and that other symptoms of paralysis of the pneumogastric nerves may be often noticed. Among them he mentions the increased frequency of the pulse beats, unaccompanied by a corresponding rise in the temperature. He also thinks that some cases of so-called hysterical aphonia belong to the class of reflex paralyses. The affection is occasionally met with in chlorosis, but it far less commonly occurs in connection with amenorrhœa than might be supposed from the writings of some authors. More often it is the simply anæmic who suffer from it. It is common in the second and third stage of phthisis: and this is an important fact,[2] as the aphonia of phthisis is almost invariably attributed to the structural changes which are too frequently encountered in that disease. Silent people, whether their silence is voluntary or forced, are more subject to functional aphonia than those who are accustomed to use their tongues freely. Catarrh is also a cause of the affection. Thus a person "catches cold," the larynx is congested, and hoarseness or aphonia occurs. The congestion disappears, but the aphonia remains owing to the feeble approximative power of the vocal cords. This train of phenomena is often met with among public speakers—especially clergymen. Professor Gerhardt [3] considers these cases as examples of *catarrhal rheumatism*, and describes two other rheumatic forms of paralysis of the adductors, viz., *meta-rheumatic paralysis*, in which acute inflammation of the joints is followed by paralysis of the adductors; and *direct rheumatic paralysis* in which the affection is the result of exposure to draughts or taking cold drinks. Of the latter class of cases I have met with some examples; of the former none. Sometimes the muscular affection is the result of direct injury of the muscles on both sides, but injuries are more likely to be unilateral. Navratil [4] has described a remarkable case in which the lateral adductors were the subject of numerous calcified trichinæ; these parasites were much more numerous in the muscles of the left than in those on the right side, and whilst the former muscles were paralyzed the latter were only in a state of paresis. Sometimes the affection is probably of a toxic character, *i. e.*, is due to the constitutional action of lead, arsenic, and perhaps other substances. As cases of *uni*lateral paralysis of the adductors of this nature have come under my notice, it is highly probable that the *bi*lateral affection may arise in the same way. Whether the rheumatic and the toxic forms are of a central or peripheral nature cannot at present be determined. It is remarkable that in the cases of toxic poisoning the *ad*ductors alone are affected, just as in lead poisoning the extensors of the forearm always suf-

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[1] Handb. d. Kinderkrankheiten, 2d edition, p. 332.

[2] In 1865, in conjunction with Dr. W. H. Stone, I examined a number of cases at the Brompton Hospital. Thirty-seven cases of phthisis, in the second and third stage *in which the voice was affected*, were selected for laryngoscopic examination. In eleven of these the affection was purely functional; in twelve there was thickening of the mucous membrane; and in fourteen there was congestion.

[3] Virchow's Archiv, vol. xxi.

[4] Berlin. Klin. Woch., 1876, No. 21.

fer—the flexors never. The truly hysterical cases are not unfrequently associated with loss of power of articulation, the lips and tongue remaining perfectly immobile when the patient is directed to make an effort to speak.

Symptoms.—When a young woman, in comparatively good health, is suddenly taken with aphonia, the case almost invariably proves to be one of paralysis of the abductors. Sometimes the voice comes and goes, and this condition has been described as "intermittent aphonia,"[1] but as it is generally merely a slighter degree of paralysis than when the affection is constant, and, as a rule, there is no regularity in the intermittence, it seems unnecessary, and even misleading, to use the term. It is characteristic of functional aphonia, that though the voluntary power of phonation is lost, the reflex function is not generally affected. The cough and the sneeze are usually accompanied with a distinctly laryngeal sound; the laugh, on the other hand, being a much feebler expiratory sound, and more under the control of volition, is not always phonetic. The laryngoscope, however, at once determines the nature of the case, for, on directing the patient to attempt to say, "*a*," the vocal cords are not closely approximated. They may approach one another slightly, or they may remain perfectly immobile, leaving a large triangular space between them. As already remarked it not unfrequently happens that though both vocal cords are paralyzed, one is affected more than the other. There is very often extreme anæmia of the laryngeal mucous membrane; but, on the other hand, in post-catarrhal cases *it may be congested.*

Diagnosis.—The only cases which are likely to be confounded with functional aphonia are those in which the loss of voice is due to feeble respiratory action—expiration not being powerful enough to set the cords in proper vibration. This source of fallacy has, however, only to be indicated to be avoided. It must further be borne in mind also that the approximative action of the cords may be interfered with by certain mechanical impediments, such as swelling of the inter-arytenoid fold, the presence of growths or cicatrices, and disease of the crico-arytenoid joints. The laryngoscope, however, generally enables the observer to detect these conditions.

Pathology.—As these cases never terminate fatally, post-mortem evidence as to the condition of the muscles could only be obtained through an accidental death occurring to a patient suffering from nervous aphonia. As yet no such case has been placed on record, and it is highly improbable that any structural changes would be discovered. The muscles are no doubt weak in most of these cases, and further, it would seem that the nerve-force is either feebly evolved, or not directed into the proper channel. The sudden restoration of the voice, which so frequently takes place, either spontaneously or as the result of treatment, can only be explained by some such theory as this. It may be mentioned, however, on the other hand, that Gerhardt[2] suggests that in some of the catarrhal cases there is probably some enlargement of the cervical glands, giving rise to pressure on the recurrent or pneumogastric nerves. The muscles which are paralyzed are the adductors—the crico-arytenoidei laterales on each side, and the arytenoideus proprius, but the thyro-arytenoid muscles are, probably, also often simultaneously affected.

Prognosis.—The prognosis, as regards cure, is very favorable, for al-

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[1] Levison: Berlin. Klin. Wochensch., 1870, No. 46.

[2] Handbuch der Kinderkrankheiten, 3ter Band, 2te Hälfte, p. 139.

though these cases are often very obstinate, and resist a great deal and a great variety of treatment, they are almost always cured in the end. During the last twenty years I have treated several hundred such cases, and in very few instances without ultimate success. In several of these cases the aphonia was of six, seven, and eight years' standing; and in one, the voice was restored after having been lost for ten years.

Treatment.—Emotional influences often cure this form of aphonia, and we have an instance of the power of the mind in restoring the voice nearly two thousand five hundred years ago;[1] but remedies which stimulate the mucous membrane of the larynx, and thus, by reflex action, cause a mild spasm of the glottis, are those most rational in principle, and most successful in practice. These stimulating remedies may be applied in the form of inhalations, sprays, or pigments, or endolaryngeal faradism may be employed. I have several times known a vapor impregnated with ammonia restore the voice. The inhalation of chlorine has also been successfully used by Professor Pancoast,[2] of Philadelphia, but the stimulating inhalations of the Throat Hospital Pharmacopœia will be found more manageable and not less efficacious. Of these the Calamus Aromaticus and Creasote Inhalations are the most active. Stimulating, or strongly astringent solutions, such as nitrate of silver (3 j. ad ℥ j.), or perchloride of iron (3 ij. ad ℥ j.) may be applied with a brush to the interior of the larynx; or these remedies can be introduced into the larynx in the atomized form. But whilst both the inhalations and local applications often fail, endolaryngeal faradism is almost always successful. Electricity applied through the neck sometimes restores the voice, but when it has been lost for any length of time the percutaneous method cannot be relied on.

In using the laryngeal electrode, one pole is passed within the glottis and placed on the vocal cords, and the other applied externally by means of a necklet (see page 186). The laryngeal rheophore should be kept in contact for a second or two and then withdrawn. The current may be applied five or six times at a sitting. It will generally be found that a distinctly laryngeal sound can be produced on the first application of endolaryngeal faradism, and that the voice will get stronger on each succeeding application. Should any hyperæmia of the mucous membrane be present it is very important not to apply the electric current until the congestion has been got rid of. I have seen many cases in which, from non-attention to this precaution, practitioners have been disappointed in the results of internal faradism.

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[1] Herodotus remarks (book i. Clio, chap. 85), "We have now to speak of the fate of Crœsus. He had a son, as I have before related, who, though accomplished in other respects, was unfortunately dumb. Crœsus, in his former days of good fortune, had made every attempt to obtain a cure for this infirmity. Amongst other things, he sent to inquire of the Delphic Oracle. The Pythian returned this answer:—

'Wide ruling Lydian, in thy wishes wild,
Ask not to hear the accents of thy child;
Far better were his silence for thy peace,
And sad will be the day when that shall cease.'

"During the storming of the city, a Persian meeting Crœsus, was, through ignorance of his person, about to kill him. The king, overwhelmed by his calamity, took no care to avoid the blow or escape death; but his dumb son" (*ὁ δὲ παῖς οὗτος ὁ ἄφωνος*, is the expression), "overcome with astonishment and terror, exclaimed aloud" (literally, broke his voice, *ἔρρηξε φωνήν*), "'Oh, man, do not kill Crœsus!' This was the first time he had ever spoken (*ἐφθέγξατο*), but he retained the faculty of speech (*ἐφώνεε*) from this event as long as he lived."

[2] Wood's Practice of Medicine, vol. i. p. 834.

Instead of these local remedies, however, more general measures may be employed. Thus where the aphonia is dependent on hysteria, the ordinary anti-hysterical treatment, especially the use of the cold shower-bath, is sometimes successful. The inhalation of chloroform also frequently effects a cure. The patient should be rendered quite insensible, and then, as consciousness is returning, should be engaged in conversation. In this way the patient is, as it were, trapped into speaking aloud, and the voice often remains when the influence of the chloroform has passed away. This treatment is, however, very uncertain, when compared with the endolaryngeal application of electricity, and only answers in the purely hysterical cases.

In most cases when the voice has once been restored, it is important to adopt measures to keep up the effect. The external application of faradism employed daily, or every other day, for a week or two, is often of great service for this purpose. The patient should also be directed to exercise the voice regularly, by counting and reading aloud—gradually increasing the exercises, both as regards their duration and the loudness of voice. For keeping up the action of the muscles "laryngeal gymnastics," first recommended by Dr. H. K. Oliver,[1] of Boston, are often useful. These consist in gentle but firm manipulations of the larynx externally; the adductors may be assisted by compressing the alæ of the thyroid cartilage in their upper and posterior part between the finger and thumb whilst an attempt is made to emit a sound. To bring the external tensors into play, the operator should stand behind the patient, and, fixing the thyroid cartilage with his thumbs, should raise the cricoid with his middle fingers at the very moment when the patient tries to produce a sound. Dr. Oliver has even found this method sufficient for restoring the voice without the previous use of electricity. Functional aphonia is so common and so easily cured by endolaryngeal faradism, that I do not think it necessary to append any illustrative cases.

Paralysis of One Lateral Adductor.[2]

Definition.—Inaction of the adductor on one side, causing the affected vocal cord to remain at the side of the larynx on attempted phonation, and giving rise to a hoarse and shrill voice.

Etiology.—The condition may be due to chronic toxæmia (lead, arsenic), or may be caused by cold or muscular strain. I have met with it after small-pox and as a result of syphilis.

Symptoms.—The condition can be detected with the laryngoscope. On attempted phonation, the affected vocal cord remains at the side of the larynx, so that it is scarcely visible, whilst the healthy one is well adducted to the median line. The mucous membrane covering the affected vocal cord may be normal, but is often congested. There is aphonia or dysphonia, and usually an absence of constitutional symptoms. When the paralysis of the adductors on one side is complete, or even well-marked, the acts of coughing, sneezing, and laughing are always altered in character, and often unaccompanied by sound; indeed, a modification of the natural

[1] American Journ. Med. Sci., April, 1870, p. 305.
[2] See foot-note, page 337.

cough or sneeze is often one of the earliest symptoms. The affection is not unfrequently associated with slight dysphagia.

Pathology.—As regards the pathological anatomy, I may observe that in the only case of this disease, which I have examined after death—a case of seven years' standing—there was considerable atrophy of the adductor (crico-arytenoideus lateralis) on the affected side. The arytenoideus proprius did not appear to have suffered.

Diagnosis.—The most likely source of error in examining a case of this sort, is to be found in swelling of a ventricular band, which in this condition more or less eclipses the true cord on the same side. It thus happens that when the larynx is examined, one vocal cord is seen to be adducted well to the median line, whilst the other is not visible at all. A little practice with the laryngoscope will enable the observer to recognize the true nature of the case. Symptoms of a paralytic character are sometimes produced by destruction or impairment of one of the crico-arytenoid joints from ossification or other morbid changes. In these cases there is generally some abnormal appearance, such as enlargement or swelling about the base of the arytenoid cartilage.

Prognosis.—The condition not being in itself dangerous, and being generally due to local causes, need not, as a rule, give rise to serious apprehensions. Only those cases which are due to chronic toxæmia, or to catarrhal or syphilitic inflammation, are amenable to treatment.

Treatment.—Some patients recover spontaneously, or by the use of warm inhalations, and where the disease is due to chronic toxæmia, the application of electricity to the laryngeal muscles often does good in recent cases. The electricity should be applied with the double electrode, which should be made to ride straddlewise over the ary-epiglottic fold, just in front of the cartilages of Wrisberg. Where, however, the aphonia has been of many years' standing before a laryngoscopic examination has been made, treatment is of little use. For here it is not as in bilateral paralysis, where the reflex action of the muscles not being interfered with, the integrity of the muscular structure is maintained.

CASES ILLUSTRATING PARALYSIS OF ONE LATERAL ADDUCTOR.

Mr. G., a well-known surgeon, practising in Bloomsbury, consulted me in 1864 on account of aphonia of several years' duration, which came on with an attack of diphtheritic paralysis some years previously. The aphonia was due to paralysis of the adductor of the right vocal cord. Neither galvanism nor faradism had any effect in this case, and the adductor remained permanently paralyzed. The action of the adductor was perfect.

The daughter of a practitioner at Anerly was brought to me in 1865, suffering from paralysis of the adductor of the left vocal cord. The cause of the paralysis was the same, and the result of treatment as negative as in the last case.

Charles E., aged forty-nine, applied at the Throat Hospital, February 3, 1867, on account of loss of voice and shortness of breath. Laryngoscopic examination showed paralysis of the adductor of the left vocal cord, which only came into view on placing the laryngeal mirror very obliquely. The patient had a temperature of 103°, and his pulse was 138, and on examining the chest, the cause was found in extensive pleurisy of the right lung. He died ten days later, and at the post-mortem examination the lower half of the right lung was found to be hepatized, whilst the

pleural cavity contained about two ounces of purulent fluid. The recurrent and pneumogastric nerves were carefully dissected, and portions submitted to microscopical examination, and they everywhere appeared healthy. The left crico-arytenoideus muscle and the fibres of the thyro-arytenoid muscles were greatly atrophied—indeed of the former there was scarcely any muscular tissue remaining. The other muscles on both sides were quite healthy. There were several deep scars, probably syphilitic, on the posterior wall of the pharynx, at the lower part, but neither scar nor contraction could be seen in the larynx. The patient's wife said that he had not spoken out loud for seven years, and that at the time he had first lost his voice he had suffered from a bad sore throat, which prevented his swallowing. The cause of the muscular atrophy was probably a gummatous deposit.

M. S., aged twenty-three, consulted me in March, 1874, on account of hoarseness of one month's duration. A laryngoscopic examination showed great congestion of the mucous membrane of the larynx, and paralysis of the adductor of the right vocal cord. Under the use of soothing inhalations the congestion disappeared at the end of a fortnight, but the right vocal cord remained absolutely immovable on attempted phonation. The abductive action, on the other hand, was perfect; six weeks later, under the continued use of faradism, the adductor recovered its power and the voice was restored.

In another case which came under my notice at the Hospital for Diseases of the Throat in December, 1875, the patient was a painter, aged thirty-five, and the adductor of the right vocal cord was completely paralyzed, apparently as the result of lead poisoning. The disease was of five months' standing, and a cure was effected in two months by the endolaryngeal application of electricity and the internal administration of bark and iodide of potassium.

Paralysis of the Central Adductor

(*Inter-arytenoid Muscle*).

This muscle is frequently affected in conjunction with the lateral adductors, and occasionally suffers alone. Its action is most often impaired through catarrh, but sometimes hysteria is the cause of the loss of power.

Loss of voice is the *symptom* of this affection; and on laryngoscopic examination, whilst the vocal cords are seen to approximate well in the anterior three-fourths of the glottis, the posterior, or cartilaginous portion of the glottis remains open, leaving a triangular space between the cords in this situation.

Fig. 97.

The *prognosis* in recent cases is favorable, but a case described below has been under observation for twelve years, and is very much in the same state as it was when first seen.

The *treatment* should consist, in catarrhal cases, of stimulating inhalations and astringent applications; but in those of longer standing faradism applied to the inter-arytenoid fold will generally be found necessary.

E. H., a spinster, aged thirty-seven, came under my care at the Throat Hospital in August, 1867, on account of loss of voice of two years' dura-

tion. The patient was sent to me by Dr. Hall, of Brighton, who had treated her some years previously for a uterine affection. She was very weak, but was free from organic disease. On laryngoscopic examination the vocal cords were seen, on vocalization, to approximate properly in the anterior three-fourths of the glottis, but to remain widely separate in the posterior fourth, leaving a triangular opening. Constitutional remedies of a tonic and anti-hysteric character were used, and endolaryngeal faradism employed. But all to no purpose. The strongest electrical shocks could not elicit the faintest sound. The patient was placed under chloroform, but on restoration to consciousness could never be made to utter a sound. This case has been under observation for the last twelve years, but it has never been possible to restore the voice.

Paralysis of the External Tensors of the Vocal Cords

(*Crico-thyroid Muscles*).

This affection may be either bilateral or unilateral, but both forms are rare. It most commonly arises from exposure to draughts of cold air on the neck, but it also occasionally results from a too violent or a too prolonged use of the voice, especially when the vocal function is exercised out of doors. In these cases the voice is sometimes only very gruff, but more often it is altogether suppressed. Occasionally, on placing the finger over the crico-thyroid muscles in the neck, and directing the patient to attempt to produce a vocal sound, the non-contraction of the muscle may be perceived. The laryngoscopic appearance has been described at page 317.

The prognosis is favorable, and rest alone often effects a cure. Percutaneous faradism is, however, indicated, and, in many cases, blistering, or even a wet compress round the neck, will hasten the restoration of function.

CASES ILLUSTRATING PARALYSIS OF THE EXTERNAL TENSORS.

Case 1.—A military man, aged thirty-nine, became voiceless after exerting himself by giving the word of command. On laryngoscopic examination, the characteristic wavy outline of the free edge of the vocal cords was very distinct (see Fig. 88). The voice was at first quite lost, but on the second day assumed a thick muffled tone, in which state it had continued for nearly two months. This case was quickly cured by means of a blister applied across the neck over the crico-thyroid space.

Case 2.—L. N., aged fifty-one, consulted me in June, 1876, on account of loss of voice which had existed for two years. On making a local examination the vocal cords were seen to be normal in color, to be well adducted to the median line, but to show undoubted signs of relaxation. The glottis, when the vocal cords were approximated, exhibiting a waved outline which constantly varied. On examining the neck I observed a transverse scar across the neck, commencing from a spot in a line with the ear on the right side, to a spot in a line with the angle of the jaw on the left side, and passing in the front between the thyroid and cricoid cartilages. The patient admitted that two years previously he had attempted to commit suicide, and that for some months afterward he had been trou-

bled with a fistulous opening in the windpipe in the centre of the throat; he stated that the wound had been very deep in its whole course, and there had been considerable hemorrhage. It was clear from the examination of the wound that the lower attachment of the crico-thyroid on each side had been completely severed. I did not think it of any use attempting any further treatment in this case.

Paralysis of the Internal Tensors of the Vocal Cords

(*Thyro-arytenoidei Interni*).

Cases frequently occur in which, on attempted phonation, the vocal cords remain slightly separated in the middle third of the glottis, and it is generally thought that this condition is due to paralysis of the internal tensors. It is not improbable, however, that in some of these cases a few fibres of the lateral crico-arytenoid muscle may be the real parts at fault. This form of paralysis is frequently met with among singers, and is due to overfatigue of the voice. Sometimes it probably results from an actual sprain of the muscle occurring as the result of some undue effort in vocalization. In the former case, rest for a few days and soothing inhalations are generally sufficient to effect a cure; in the latter, the affection can often be only overcome by rest of many months' duration, and it is often incurable. Endolaryngeal galvanism is useful in cases resulting from overfatigue and following catarrh, whilst faradism is more beneficial in those which are of an hysterical character.

Fig. 98.

Paralysis of the Thyro-Arytenoid Muscles of Three Years' Standing Cured by Endolaryngeal Faradism.—A young lady, aged twenty-six, of delicate appearance, but not at all hysterical, was sent to me by Mr. Tapson, in 1863, suffering from aphonia of three years' standing. The loss of voice commenced with an ulcerated sore throat, but when the ulcer healed her "voice did not return," and she continued, during the whole of the time previous to coming under my observation, unable to speak above a whisper. She had undergone a considerable amount of treatment by caustic applications and external galvanism, combined with the administration of anti-neurotics. On making a laryngoscopic examination, the cords were seen to be very pale and narrow. On attempted phonation they approximated well, but were still distinctly relaxed, whilst an upward bulging toward their centres was quite perceptible. Under the use of electricity, applied to the vocal cords by means of my laryngeal electrode, her voice was restored in about three weeks.

[Though I formerly reported [1] this case as one of paralysis of the crico-thyroid muscles, the fact that the affection rapidly yielded to laryngeal faradism, whilst it had resisted percutaneous electricity, strongly points to the conclusion that the internal adductors were mainly affected.]

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[1] Hoarseness and Loss of Voice, etc. Second edition, p. 46.

Mixed Paralyses.

It will be easily understood that paralyses do not always occur in the simple forms which have been described in the foregoing articles, and that the shape of the glottis will vary according to the combination of muscles paralyzed. As a rule, the lateral adductors and central adductor are affected together, and in that case the glottis represents a triangular opening. Sometimes, however, the internal tensors are affected, together with the central adductor (arytenoideus proprius), whilst the lateral adductors are only slightly affected; an image is then presented which combines the features of the double paralysis. The laryngoscopic appearances are, under the circumstances, made up of Fig. 97 and Fig. 98. Although in these figures the paralysis is portrayed as bilateral, the reader will readily appreciate the modification of form which takes place when only one side of the larynx is affected.

Not only do the combinations of paralyses vary immensely, but spasm of some muscle may occur at the same time as paralysis of others. Hence it can be readily conceived that the resulting laryngoscopic image may undergo great complications, and that the permutations of which it is capable are often difficult, and sometimes impossible, to decompose.[1]

Atrophy of the Vocal Cords.

Atrophy of the vocal cords is extremely rare, and, as far as I am aware, has not been proved to exist by post-mortem evidence. I have, however, reported four cases[2] in which there was every appearance of atrophy during life. The rarity of the affection is probably due to the exceedingly dense structure of the vocal cords and the slowness with which the nutritive changes take place in the normal condition. When there is wasting the cords may have merely a shrunken appearance, or they may be so withered, that, although there is no obstruction to inspection, they cannot be brought into view. Besides my own cases, Ziemssen[3] has given an illustration of this affection, but he remarks that a case came under his notice in which pressure on the recurrent nerve existed for seventeen years without causing any atrophy of the corresponding vocal cords.

Anchylosis of the Arytenoid Articulations.[4]

Notwithstanding the exposed position of the crico-arytenoid articulation, fixature of the joint must be rare, for immobility of the vocal cords is not a very common condition, and where it does exist it is often due either to nervo-muscular affections, or to general tumefaction of the soft parts, which mechanically prevents the movements of the cords. That it does occasionally occur, however, there is little doubt. This subject has not been hitherto treated with any detail, although the condition has been in-

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[1] Koch: loc. cit.

[2] Hoarseness and Loss of Voice, p. 71.

[3] Cyclopædia, vol. vii. p. 955.

[4] This article would have been more appropriately inserted after Perichondritis, but having been accidentally omitted in its proper place, I have thought it better to insert it here, affections of the joint being so likely to be mistaken for muscular paralyses.

cidentally referred to by Türck,[1] Sidlo,[2] Ziemssen,[3] Mandl,[4] Schroetter,[5] Koch,[6] Burow, Jun.,[7] Semon,[8] and myself.[9] Anchylosis of the crico-arytenoid joint may arise from perichondritis or chondritis, either of which may occur primarily or result from extension of disease from the superjacent soft parts. It is probable also that it may be due to primary synovitis, either rheumatic, gouty, or simply catarrhal, and in some cases it most likely arises from mere disuse, brought about either through the muscles having been previously paralyzed, or through changes in the contiguous parts preventing the movement of the joint for a long period, and thus giving rise to permanent anchylosis. Or the fixature may be due to traumatic injuries, such as wounds, contusions, or dislocations. Perichondritis, generally due to typhoid fever or syphilis, is undoubtedly the most common cause of the affection; for, according to Dr. Semon, out of ten cases on record in five instances the disease was due to inflammation of the perichondrium covering the cricoid or arytenoid cartilages. The symptoms vary according as the disease is unilateral or bilateral, according to the degree of mobility of the joint, and according to the position in which the arytenoid is fixed on the cricoid cartilage. Thus, if the arytenoid be fixed on the outer part of the cartilage we have the vocal cord permanently drawn aside, and permanent dysphonia, whilst if the arytenoid cartilage is fixed near the centre of the cartilage, the vocal cord is permanently fixed near the median line, and there is persistent dyspnœa.

The diagnosis of the condition is attended with some difficulty, and paralysis of either of the adductors or the abductors may simulate anchylosis; the affection may, however, be inferred to exist when immobility of one or possibly of both the vocal cords is accompanied by some marked irregularity in the form of the cartilages, or the upper part of the cricoid cartilage. It should be also specially looked for in the case of patients who are convalescent from typhoid fever, and have some alteration in voice, or difficulty in breathing. I am not aware that any treatment would be likely to give very satisfactory results; but if the arytenoid cartilages are fixed in a central position forcible dilatation should be effected according to the mechanical methods laid down in the last article, after tracheotomy has been performed; and this treatment should, if possible, be employed *prophylactically* in cases of perichondritis after typhoid fever and syphilis, in which considerable destruction of the joint has taken place, and subsequent anchylosis is to be feared.

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[1] Klinik der Krankheiten des Kehlkopfs, etc. Wien, 1866, p. 214.

[2] Ziemssen's Cyclopædia, vol. vii. p. 968.

[3] Cyclopædia, vol. iii. p. 821. English edition.

[4] Gazette des Hôpitaux, Nro. 20, 63, 1862.

[5] Beitrag zur Behandlung der Larynxstenosen, Wien, 1876; and Jahresberichte der Klinik für Laryngoscopie, Wien, 1871 and 1875.

[6] Annales des Maladies de l'Oreille, etc., 1877, Nov. 6, p. 335, and 1878, Nov. 2, p. 13.

[7] Laryngoscopischer Atlas, Stuttgart, bei Enke, 1877, p. 66.

[8] Trans. Clin. Soc., vol. xi. 1878, p. 149; and Med. Record, Jan. 1879, No. 84. p. 21. My colleague, Dr. Semon, is also preparing an exhaustive article on the subject of anchylosis of the arytenoid articulations, and he has kindly permitted me to peruse his manuscript.

[9] Hoarseness, Loss of Voice, and Stridulous Breathing, London, 1868, pp. 6 and 18.

SPASM OF THE GLOTTIS.[1]

(Synonyms: Spasm of the Abductors of the Vocal Cords. Spasmodic Croup. Cerebral Croup. Millar's Asthma. Child-crowing.)

Latin Eq.—Spasmus glottidis. Laryngismus stridulus. Asthma Millari. A. Koppii. A. intermittens infantum. Angina spastica. Clangor infantum.
French Eq.—Spasme de la glotte. Pseudo-croup. Croup nerveux.
German Eq.—Krampf der Glottis. Stimmritzenkrampf.
Italian Eq.—Spasmo de la glottide.

Definition.—A form of convulsions occurring in ill-nourished (usually rickety) infants, characterized by spasmodic action of the abductors of the vocal cords, and, in severe cases, by spasm of the diaphragm and intercostal muscles. The most marked symptom of the disease is a succession of short, stridulous inspirations, which gradually become more prolonged, and generally culminate in a fit of ordinary crying, though sometimes they result in complete cessation of respiration and death.

History.—This disease has presumably existed from time immemorial, for the conditions which give rise to it have probably always been in operation. In the earliest medical records we find it described under the name of "the asthma of children," and Hippocrates,[2] in referring to it under this head, mentions that it occurs soon after the first teeth begin to appear. Two or three hundred years later, Galen,[3] with greater precision, but less accuracy, stated that the age at which the disease is most frequently met with is from the time of the cutting of the first teeth to the twelfth or thirteenth year. The references to the affection by Aretæus, Paulus Ægineta, and Celius Aurelianus are very vague, and it was not until the end of the seventeenth century that the disease was described with any degree of accuracy. In the year 1697, however, Etmuller,[4] gave an account of the "suffocative convulsions of infants," which he thought might arise either from spasm of the closers or paralysis of the openers of the glottis.[5] In the year 1761 Dr. James Simpson[6] published a short essay which may be regarded as the starting-point of the modern views regarding the disease; and, a few years later, Dr. John Millar[7] published an important work, in which Simpson's observations, previously but little known, were considerably elaborated. Millar appears to have met with cases of catarrhal laryngitis, and possibly with cases of laryngeal diphtheria, but he also no doubt had observed examples of true laryngismus. In his "first and second stages" of laryngismus, he did not clearly discriminate between these three affections, and hence it is not remarkable that his views, both as regards the etiology and treatment of the disease, are somewhat con-

[1] It is important to bear in mind that spasm of the glottis is not in itself a disease, but merely the symptom or local expression of disease existing elsewhere.
[2] Aphorism., sect. 3, aph. 26.
[3] Obs., lib. l., p. 184.
[4] Op. om., 1697, vol. ii. p. 273 et seq.
[5] Ibid. p. 263.
[6] Dissertatio Inaug. de Asthmate Infantum Spasmodico, Edin., 1761.
[7] Observations on the Asthma and the Whooping Cough, 1769.

fused. Underwood[1] gave a tolerably clear account of the disease in 1789, and Wichman,[2] of Hanover, appears to have accurately portrayed it about the year 1795. The affection was subsequently described with considerable detail by Burns,[3] Hamilton,[4] Clarke,[5] and other writers on the diseases of women and children. After this for a time the complaint attracted little attention, and it was not until Kopp[6] published his celebrated work, in which he attributed the affection to enlargement of the thymus gland, that we again find any activity of research in connection with the subject. Kopp's treatise called forth a number of articles in Germany, and soon afterward a most scholarly work was published in this country by Dr. Ley.[7] This classical production contains an admirable account of the pathology of the nerves, as far as it was known at that period, but its clinical value is diminished by the peculiar views of the author as to the etiology of the disease. Dr. Ley considered that laryngismus is always due to *paralysis* of the abductors arising from pressure of strumous, bronchial, or cervical glands on the recurrent or pneumogastric nerves. In 1841 Dr. Marshall Hall,[8] in a work which revolutionized the previously existing views as regards the physiology and pathology of the nervous system, referred laryngismus in all cases to reflex causes. In 1843 Elsässer[9] published a book in which he attributed laryngismus to softening of the occipital bones and the consequent pressure to which the brain is subjected when the child lies on its back; and though this theory of causation has since been shown to be incorrect, the work was of great value in drawing attention to the frequent association of the rachitic condition and laryngismus. In 1847 an able essay (the first important treatise on the subject that had issued from the French school) was written by Herard.[10] Two years later the interesting work of Dr. James Reid[11] appeared, and in 1858 Dr. Friedleben[12] forever disposed of the thymic theory by showing that, even when greatly enlarged, the gland never presses on the recurrent nerves or trachea.[13] In 1867 Professor Henoch[14] published an important lecture on the subject, and in the following year Löschner[15] described the immediate conditions leading to an attack of laryngismus with marked ability. The subject of laryngismus has lately been treated in a very complete manner by Steffen[16] and Flesch.[17] In the above short

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[1] Diseases of Children, second edition.

[2] This work is referred to by Steffen and Flesch, but the best account of its contents is found in Hugh Ley's work. I have not been able to find a copy of the original article.

[3] Principles of Midwifery, 1809.

[4] Diseases of Infants and Children, seventh edition, 1813.

[5] Commentaries on Important Diseases of Children, 1815.

[6] Denkwürdigkeiten in der ärztlichen Praxis, Frankfort, 1830.

[7] Essay on Laryngismus Stridulus, London, 1836. I am indebted to this work for much of my knowledge of the history of the disease.

[8] The Nervous System, etc., 1841.

[9] Der weiche Hinterkopf, Stuttgart, 1843.

[10] Du Spasme de la Glotte, Thèse de Paris, 1847.

[11] On Infantile Laryngismus, London, 1849.

[12] Die Physiologie der Thymusdrüse in Gesundheit und Krankheit, etc., Frankfort, 1858.

[13] Notwithstanding the conclusive character of Dr. Friedleben's work, the thymic fallacy has again been revived by Dr. Abelin (Meddelanden från Pediastrika Kliniken å Allmänna, Barnhusdt i Stockholm for Ar., 1868).

[14] Berlin. Klin. Wochenschrift, 1867, No. 19.

[15] Aus dem F. J. Kinderspitale in Prag. Prag, 1868, p. 144.

[16] Ziemssen's Cyclop., vol. vii.

[17] Gerhardt's Handbuch, etc., 3ter Bd. 2te Hälfte.

historical *résumé*, it has been impossible to do justice to nearly all the authors who have written on the subject, but the names of Lorent, Salathé, Meigs, Lederer, Hauner, West, Fleischmann, and Gerhardt, must not be altogether omitted.

Etiology.—Spasm of the glottis is comparatively rare, having been observed only 297 times among 112,657 sick children at the Great Ormond Street Hospital. The causes of the affection are involved in considerable obscurity, and the etiological views concerning it have from time to time undergone much change. The development of the disease may, however, be conveniently considered in relation to predisposing and exciting influences. Among the former are age, sex, social condition, season of year, physical organization, and heredity. Amongst the exciting causes must be reckoned anything which teases the child or directly irritates the larynx.

Age is undoubtedly the most influential predisponent to the disease. Not only is the nervous system, when undergoing the rapid developmental changes of infancy, very prone to take on morbid action; but the small size of the glottis, and the yielding character of the tissues of the larynx in the young, cause very slight changes to give rise to marked symptoms. Flesch[1] considers that the disease is very rare after the twenty-first month, and Steffen[2] remarks that by far the majority of cases occur between the age of four months and the completion of the second year. In my own 31 cases the ages at which the attacks occurred were as follows:—From birth 1 case, at 4 months 1 case, at 5 months 6 cases, at 6 months 5 cases, at 7 months 7 cases, at 9 months 3 cases, at 10 months 1 case, at 11 months 2 cases, at 15 months 3 cases, at 17 months 1 case, and at 23 months 1 case. Dr. Gee[3] found in 48 cases, 1 at six months, 19 from 6 to 12 months, 16 from 12 to 18 months, and 12 from 18 months to 3 years. In 31 out of 37 cases seen by West,[4] the affection occurred between the age of six months and 2 years. The following tables compiled from the Registrar-General's Reports, showing the number of deaths, for the twenty years 1857 to 1876 inclusive, from the disease occurring at different ages, afford still more conclusive evidence as to the importance of age as a predisponent.

ANALYSIS OF THE REGISTRAR-GENERAL'S REPORTS ON THE MORTALITY FROM LARYNGISMUS.

Children under 10 *Years of Age.*

	Totals.	Years of Age.					
		Under 1 Year.	1	2	3	4	From 5 to 10 Years.
Females.....	2,547	1,487	691	152	94	60	63
Males.....	4,771	2,915	1,395	213	97	63	88
Grand Total.....	7,318	4,402	2,086	365	191	123	151

[1] Loc. cit. [2] Loc. cit.
[3] St. Barthol. Hosp. Reports, vol. iii. p. 104.
[4] Diseases of Infancy and Childhood, sixth edition, p. 190.

Adults.

	Totals.	Years of Age.								
		10	15	20	25	35	45	55	65	75
Females	13	5	..	1	2	2	1	1	1	..
Males	24	7	1	2	2	2	3	..	4	3
Grand Total	37	12	1	3	4	4	4	1	5	3

The influence of *sex* is the same as in most laryngeal diseases, boys being much more frequently affected than girls. Steffen has collected from different authors 554 cases, of which 386 occurred in male children, and 168 in females. Of 297 cases seen at the Hospital for Sick Children, 166 were males and 131 females; whilst of fatal cases appearing in the Registrar-General's Returns 4,771 were boys and 2,547 girls. In Gee's 48 cases, 34 were males and 14 females, whilst of my 31 patients 21 were boys and 10 girls.

Social condition has a decided influence, the children of poor parents being more liable to the disease than those of the well-to-do, for reasons which will be explained under head of "Physical Organization." The influence of *season* is considerable. It has been shown by Henoch, and by Barthez and Rilliet, that the disease is much more common in the earlier than in the later months of the year, and these observations have been confirmed in a remarkable way by Dr. Gee,[1] who out of 63 cases observed 58 in the first six months of the year, and only 5 in the last six months. The following summary shows the number of Dr. Gee's cases occurring in each month: January 3, February 11, March 7, April 13, May 16, June 8 (total 58), August 1, September 0, October 1, November 1, December 2 (total 5). Of my 31 cases 19 occurred in the first, and 12 in the last six months of the year. The greater predisposition to the disease in the late winter and early spring months is attributed by Dr. Gee to the exalted nervous condition of the children, induced by their being kept indoors during these months, and this ingenious explanation is independently advanced by Flesch.

The *physical organization* of the child is probably the most influential factor in the production of the disease. Children who are ill-nourished, and live in badly ventilated rooms, are, above all others, most subject to the complaint. Amongst the upper classes, hand-fed children are most frequently attacked, whilst amongst the poor the affection is most common where the mother is in bad health, or continues to suckle for a long time. The disease, as was first pointed out by Millar,[2] often comes on at the time of weaning, an occurrence caused by the use of farinaceous food which the child is unable to digest. In a very large proportion of cases the children who suffer from laryngismus are rickety. Flesch[3] says that in three-fourths of the cases rickets is present. Gee[4] found rickets in 48 cases out of fifty occurring amongst the poor, and in my own 31 cases—

[1] Op. cit. vol. xi. p. 47.
[2] Op. cit.
[3] Loc. cit.
[4] Op. cit. vol. iii. p. 103.

all of which occurred in private practice—the rachitic condition was present to a slight extent in 17 cases, whilst in 2 cases it was very marked. It does not follow that rickets is to be regarded as a cause of laryngismus, although this view has been advocated and will be again referred to (see "Pathology"), but there is no doubt that the two conditions very frequently coexist.

As regards *heredity*, I am not aware that there are any cases which actually prove the descent of the disease from parent to child, but my cases, which are here reported, strongly point to consanguineous influence. The cases reported by Gerhardt[1] in which laryngismus proved fatal to seven out of a family of nine, and the cases related by Reid,[2] in which, out of a family of thirteen, ten died of the disease and only one escaped an attack, may all be explained on the supposition that in each instance all the children were exposed to the same anti-hygienic conditions.

A gentleman of slightly strumous organization married a healthy woman, and had two boys and two girls. They none of them suffered from laryngismus, but the influence of the father's constitution was shown in the children by enlarged cervical glands, hypertrophied tonsils, and early decay of the teeth. The family grew up; all married, and all had children. In two of the families one child had laryngismus, and in one family two children suffered from the disease, and in one family three children were affected. In all four families the children were slightly rickety.

The exciting causes of laryngismus, as stated above, are to be found in anything which teases the child, and more particularly in such conditions as irritate the throat or larynx. Thus crying will often bring on an attack. This is very intelligible when we remember that in crying or sobbing, the inspirations are always short and jerky, and indeed allied in their character to those of laryngismus. Again, a fit may often come on during sucking, either from a little milk getting into the larynx, or from the altered condition of respiration, owing to the child breathing entirely through the nose. It is, however, possible that the attack in these cases is due to the irritating character of the food when it comes in contact with the lining membrane of the stomach. Dandling the child in the arms, again, often brings on an attack. This is probably owing to the sudden descent through the air, for we notice that adults in a rough sea, when the vessel descends into the trough of the waves, have a disposition to take a short inspiration and then hold the breath. The same sensation is also often experienced, and met in a similar manner, in swinging during the process of descent. In health during sleep the state of the brain is probably that of comparative anæmia, and the respiratory function is more feeble than at other times; hence if the brain is abnormally anæmic (or otherwise the subject of molecular deterioration), or if the respiratory function is in an unstable condition, it is obvious that the sleeping state may bring on an attack of glottic spasm; but whether sleep exercises its unfavorable influence through the nerve-centre, which specially presides over the general function of respiration, or through that which controls the laryngeal muscles, cannot be determined. The possibility, moreover, of an attack being induced by a little saliva passing into the larynx, or by mucus drying on the surface of that organ, must

[1] Lehrbuch der Kinderkrankheiten, 1871, p. 285.
[2] Lancet, May 1, 1847.

not be ignored. An accidental catarrh is also extremely likely to promote an attack, whilst of the more distant sources of irritation indigestible food is the most common, though diarrhœa and worms are in rare cases immediate causes of the disorder. Difficult dentition also occasionally acts as an exciting cause, but the influence of this condition in laryngismus has been enormously overrated.

Symptoms.—The first attack of laryngismus often comes on at night—frequently toward eleven or twelve o'clock, when the first deep sleep is passing off. It may occur to a child who up to that moment had seemed perfectly well, but more often the subject of the attack has been peevish and fretful for a few days before, has suffered from loss of appetite and been restless at night, or a slight "catch" has been noticed in its breathing. A severe fit of laryngismus may thus be described: a number of short stridulous inspirations take place, each inspiration being a little longer than the preceding one, and the last being often very prolonged. Suddenly the sound ceases, the glottis is completely closed, and the respiratory movements of the chest are suspended. The flush which first suffused the countenance gives way to pallor and afterward to lividity. The eyes stare, or the eyeballs roll, the head is thrown back and the spine is often bent as in opisthotonos; the veins of the neck are turgid, the fingers close on the thumb, which is bent in the palm, and the hands are flexed on the wrist. Spasm likewise affects the feet; the great toe is drawn away from its fellows, the foot is flexed and rotated slightly outward. In some cases these so-called "carpo-pedal" contractions are probably accompanied with great pain, and occasionally they are followed by general convulsions. Notwithstanding the severity of the paroxysm just described, it is not necessarily fatal; the patient may survive it, in which case the diaphragm soon relaxes, a stridulous inspiration is heard, air enters the lungs, and the spasmodic contraction of the feet and hands gradually yields. But when the symptoms are of the dangerous character just described, the paroxysm is probably destined to be quickly followed by others, in one of which the child may die. In less severe cases all the symptoms are less marked, and the carpo-pedal contractions are often altogether absent. The attack frequently comes on whilst the child is at the breast. The infant suddenly stops sucking and looks round, its eyeballs are turned up, and after a second or two a loud crow is heard; the infant then returns to the breast or the bottle, but only to be seized immediately afterward with a similar paroxysm. Sometimes each attempt to suck brings on such an alarming attack of spasm, that the unhappy mother hesitates between the alternatives of starvation and suffocation. Again, in other cases, the attack assumes the form of a sudden, almost soundless spasm, which does not relax till life is extinct. In very rare cases a slight but constant spasm is shown by stridulous breathing. In the common type of cases when the attack has occurred for the first time at night, the child may appear to be quite well on the following day and there may be no further return of the symptoms; but it more often happens that another attack comes on a few hours afterward or at the same time on the following night. Sometimes the second attack supervenes almost as soon as the child has recovered from the first, in which event it is generally more serious, both in its character and duration, than the first. In severe cases, indeed, the paroxysms are so frequent that the child is scarcely out of one fit before it is again attacked. As a rule there is an entire absence of pyrexia in these cases, though sweating of the head, so characteristic of the rachitic constitution, is almost always present.

Now and then the patient may look healthy and may even be plump, but on closer examination it will be found that the muscular system is weak, that the child is easily fatigued, and that it shows other signs of feeble organization.

Diagnosis.—The absence of fever and the obstinately intermittent nature of the affection differentiate it sufficiently from laryngeal diphtheria (croup) and catarrhal laryngitis. Paralysis of the abductors—a very rare affection in childhood—might, however, be mistaken for spasm of the adductors, and it is thus important to carefully distinguish between these two conditions. In the paralytic cases there is, as Dr. Marshall Hall [1] has pointed out, "*a constant but partial closure*" of the glottis, the vocal cords never being abducted from their paralyzed position, but always leaving a small opening through which the air can pass. In spasm of the adductors, on the other hand, there is *inconstant but complete closure of the glottis;* in other words, there is considerable movement of the cords, which are at one moment widely separated and at another so closely approximated that air cannot pass through the glottis. The symptom in the one case is constant dyspnœa, increased on the slighest exertion, whilst in the other it is occasional dyspnœa, with complete intermission between the attacks. This, however, is not an absolute law, for on three occasions I have seen slight constant stridor in the case of children in whom the other symptoms were of a spasmodic character (carpo-pedal contractions and convulsions). Not unfrequently the question can be determined by laryngoscopic examination.

Pathology.—The disease was for a long period regarded as cerebral, but the brilliant discoveries of Marshall Hall [2] led that eminent physiologist to seek for the invariable cause of the disease in some gross form of local irritation operating in a reflex manner. Hence he described it [3] as originating "in the trifacial in teething, in the pneumogastric in over or improperly fed infants, and in the spinal nerves in constipation, intestinal disorder, or catharsis." "This view," he observes, "is entirely new, and is the only true one." The tendency of modern thought has been, however, rather opposed to the explanation of laryngismus by the reflex theory, and the weight of evidence points to the probable existence of molecular changes in the nerve-centres as the essential cause of the phenomena. These changes are the result of mal-nutrition affecting all the structures of the body. We know that convulsions may occur from simple anæmia of the brain, as in a healthy parturient woman from severe hemorrhage, and there is every probability that the convulsions of children—of which laryngismus is only a form—are often due to an analogous condition. Though spasm of the glottis is most common during the period when the child is cutting its teeth, the influence of dentition has probably been greatly overestimated, the relation of the latter condition to laryngismus being seldom an etiological one. The dental system, like certain other parts of the organism—especially the nervous economy—undergoes great developmental changes in the first year or two of infantile life, but spasm of the glottis can seldom be directly attributed to irritation of the gums. Overfeeding and bad feeding are, so far as their ultimate results are concerned, equivalent terms, and, like intestinal disease, operate more by causing malnutrition of the nerve-centres than through reflex action. Löschner [4] has endeavored to show that in all cases of laryngismus there is vascular

[1] Op. cit. p. 77.
[2] Philosoph. Trans., June 20, 1833.
[3] The Nervous System, etc., 1841, p. 171.
[4] Op. cit.

engorgement of the brain and its membranes from mechanical obstruction of some kind; but this view cannot be entertained, for laryngismus is often absent when obstruction actually exists, and, on the other hand, in fatal cases of the affection there is often no evidence of vascular engorgement of the brain. The influence of rickets must now be briefly considered. Elsässer's explanation that rickets produces the disease by causing a soft condition of the occipital bone, which permits pressure on the brain, is now quite exploded, and Steffen has put forth a much more ingenious theory. He points out that irritability of the nervous system is one of the most marked features of laryngismus. This irritability is increased, if not caused, by the rachitic condition in the following manner: the lateral flattening of the thoracic parietes, and the consequent diminution of the capacity of the chest, leads to more superficial respiration, and therefore to increased frequency of the respiratory function; this necessitates greater activity of the heart, greater wear and tear of the system, and consequent cerebral irritation. The two conditions are probably, however, coincident results of a certain general condition of malnutrition.[1] Looking at the immediate phenomenon of the disease, it must be regarded as a spasm of a limited number of muscles, brought about by an abnormal condition of certain nerve-centres. The various nerve-centres, as Dr. Hughlings Jackson[2] has pointed out, are probably not knit together so closely in the infant as in the adult, and a partial convulsion—such as is seen in laryngismus—points to an imperfect union of different sections of the nervous system. Dr. Jackson explains the occurrence of the carpo-pedal contractions in children in the same way, suggesting that the centre for the limbs is not so fully developed in young subjects, and hence that spasms of certain groups of muscles may take place which would be impossible in adults.

Prognosis.—According to the Registrar-General's Reports, this disease rarely proves fatal, only about 600 cases being returned annually for England and Wales. It is probable, however, that many cases of laryngismus are certified as "croup," whilst many others appear under the head of "convulsions" and "rickets." We must therefore judge of each case on its own merits, the age and strength of the patient, and the severity of the attack being the principal factors to be taken into consideration. The prognosis also depends on the character of the paroxysm and its supposed cause. Those cases due to defective feeding, if not too advanced when first seen, generally do well, whilst those due to obvious cerebral irritation are more frequently fatal. The length of the intervals between the paroxysms is a good prognostic guide; the longer the interval the greater is the chance of recovery.

Treatment.—The treatment must be two-fold; first, to relieve the spasm; and, secondly, to remedy the general condition which causes the fits. The immediate treatment usually falls to the nurse or the mother, and the attack has often passed off—sometimes, indeed, life is extinct—before the practitioner arrives. The little patient should be raised, and

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[1] The word "rachitis" was coined by Glisson (Tractat. de Rachitide, London, 1650) from its resemblance to the popular term "rickets" by which the affection was previously known in England, whilst at the same time its resemblance to ῥάχις, the spine, gave it a learned appearance. The word "rickets" is probably derived from *rucket*, a provincial word (allied to the Danish *skrukke*, to cluck like a hen), meaning to breathe with difficulty—rickety children with their pigeon-breasts and flattened sides, always breathing feebly, and often dying from bronchitis and pneumonia, as well as laryngismus.

[2] Russell Reynolds' System of Medicine, vol. ii. p. 220.

placed in a sitting posture; he should then be slapped on the back, cold water should be dashed in the face, and ammonia or strong acetic acid held to the nose. If these remedies are not successful the warm bath should be used; or, better still, the lower part of the child's body should be placed in a bath at 95°, whilst cold water is dashed in its face. Emetics may be given directly there is a sign of stridor, for when the paroxysm is present the child cannot drink. Steffen suggests that apomorphia may be injected under the skin, in order to excite vomiting; and the great advantage of this remedy is that it can be used when the child is unable to swallow. A favorite remedy in Germany, when the jaws are not closed, and one that is highly successful, is tickling the fauces with the finger or a feather, until vomiting is produced Depressing enemata, such as tobacco, have likewise been recommended, but their use is attended with considerable danger. An injection of twenty or thirty drops of tincture of assafœtida in an ounce of warm gruel is, however, a safe and useful remedy. The inhalation of chloroform often at once relieves the spasm, but anæsthetics of course must be used with great care, and cannot be employed with safety by non-professional persons. Tincture of castor has several times proved of service in my hands, but musk is still more valuable. Musk may be administered during the attack, if the child can swallow; if not, this drug should be given as soon as the child can take it. The following is the formula which I am in the habit of employing: ℞. Moschi gr. iss., Sacch. Alb. gr. ij., Pulv. Acaciæ gr. ij., Syrup. Aurantii Flor. ℥xx., Aquam ad ʒ j. The immediate cause of the attack should, if possible, be ascertained. If the fit comes on during sucking, either from the leather-teat of the bottle, or whilst the child is at the breast, it must be fed, as Flesch insists, with a very small teaspoon—no matter how difficult at first it may be to get nourishment taken in this way.

The attack having passed off, the general condition of the child must be attended to. A brisk, but not too powerful, purgative should be administered to get rid of any irritation that may exist in the primæ viæ. Mercurial purgatives, such as calomel or gray powder, in combination with rhubarb or scammony, and an alkaline carbonate, are the most serviceable drugs for this purpose. The musk-mixture may generally be continued with advantage for twenty-four or thirty-six hours; and if the fits have occurred at night a small dose of chloral (gr. v.) should be given at about six or seven o'clock in the evening. After thirty-six hours, it is generally desirable to bring the child under the influence of bromide of potassium, five grains of the salt being given three times a day. The greatest attention should be paid to the proper administration of food, both as regards frequency, quantity, and quality. It is most important that a sufficiently long interval—varying according to the age of the patient—should intervene between the feeding hours. If the child has been brought up by hand a wet nurse should, if possible, be at once obtained; but if this is impracticable, the child's diet should be confined to animal food. Cows' milk, diluted with an equal portion of water, or undiluted asses' milk, may be given. Thin beef-tea also forms an excellent food for these children under six months of age, and as soon as the teeth are cut, finely chopped or pounded meat may be allowed. Cod-liver oil is a useful article of food in this affection, and should be taken regularly for some months. On the other hand, farinaceous articles must be absolutely forbidden.

Spasm of the Glottis in Adults.

This affection attacks adults under two conditions. Thus it may be a neurosis or may be the result of direct irritation of the larynx, such as we see in cases of laryngeal œdema or polypi, and when foreign bodies become impacted in the larynx. In these latter conditions the spasm is a dangerous complication, which can only be overcome by dealing with the essential disease or accident. In this article, however, spasm of the glottis will only be considered in so far as it occurs as an idiopathic affection, or in some rare cases as a reflex phenomenon. Spasm of the glottis in adults usually affects women, and the statistics of fatal cases extracted from the Registrar-General's Returns (see pages 351, 352), which point to an opposite conclusion, are probably based on cases in which the spasm was a condition superadded to organic disease, or traumatic injury. In adults the affection is generally regarded, with justice, I think, as an hysterical phenomenon. In the ordinary manifestations of acute hysteria the paroxysm generally culminates in a deep stridulous inspiration, which in severe cases is followed by temporary arrest of respiration and even opisthotonos. The condition indeed, as Dr. West has pointed out, is closely allied to the laryngismus of children. So likewise when spasm of the glottis becomes chronic—or perhaps it would be more correct to say frequent—the subjects of the affection are usually hysterical women. I have occasionally, however, seen the condition persist during the most profound sleep, a circumstance which shows that it may occur quite independently of hysteria.[1] In the case of adults, as in that of children, irritation of one of the recurrent nerves may give rise to an attack.[2] The dyspnœa and stridor are often very great, but I have never met with a fatal case of functional character. On laryngoscopic examination the mucous membrane may appear of a perfectly healthy color, but there is often slight congestion, and not unfrequently a small quantity of viscid secretion is expectorated from time to time. The vocal cords can be seen separating for an instant and then becoming spasmodically approximated. The sensibility of the larynx is not generally altered, and I have frequently introduced the laryngeal sound without exciting coughing. Inhalations of chloroform or hot steam often give rapid relief. The former need not be given so as to produce insensibility. I generally order 40 minims to half a pint of water at 150°. The same quantity of chloroform should be added every five minutes, until some relief is obtained. The preparations of conium, especially the Vapor Conii of the Throat Hospital Pharmacopœia, will be found very useful, and I have seen the spasm yield immediately to the inhalation of the smoke of burning stramonium or datura tatula. Valerianate of zinc is a useful remedy, especially in combination with assafœtida (Pil. Zinci Valer.: Throat Hosp. Phar.).

Where medicated solutions have to be applied to a larynx in which spasm is very easily excited, the patient should be directed to hold his breath during the time the application is being made and for a second or two afterward, and to recommence breathing very gently, and only through the nose.

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[1] Medical Times and Gaz., Nov. 15, 1862.
[2] See a case by Dr. Budd, Med. Times and Gaz., Feb. 6, 1859.

Nervous Laryngeal Cough.[1]

This affection may perhaps be more appropriately treated in connection with spasm of the glottis than in any other section. In its etiology nervous cough closely resembles laryngismus stridulus, being generally the result of some peculiar condition of the nervous system. Occasionally also, as in that complaint, it is the result of reflex irritation in the intestinal tract. The term "nervous laryngeal cough" is used to describe a shrill, often indeed extremely metallic, cough, which, in the entire absence of any laryngeal or pulmonary affection, occurs in paroxysms, and lasts for many hours each day, only ceasing when the patient sleeps at night. Sometimes it prevents the sufferer from getting any sleep, or, coming on in the night, keeps her awake for many hours. The subjects of the disease are generally young girls from 16 to 20, but I have met with it among boys of 14 and 16, and I have seen it several times in children between 5 and 14 years of age. The cough has frequently a very peculiar and even startling sound, being often deep and vibratory, or even occasionally resembling the barking of a dog or the quacking of a duck. Two cases have come under my own notice in which the cough was remarkable for extraordinary loudness. In one patient, a boy of sixteen, the cough lasted three weeks, coming on every three or four minutes, but passing off in a couple of seconds on each occasion. The volume of sound produced was most astonishing, and was compared to the deeper notes of a clarionet, blown with great violence. In another case, that of a young lady, the cough was so loud and so constant, that her friends were required by the proprietor of the hotel in which she was staying to have her removed, as she was a nuisance to all the other guests. Examination with the laryngoscope revealed nothing abnormal in these cases, nor was the general health affected. In very rare instances the peculiar sound of the cough is absent, its almost uninterrupted continuance on the one hand, and the healthy condition of the larynx and absence of any bronchial inflammatory affection on the other, alone showing the nervous character of the phenomenon. Rühle[2] has observed that in nervous cough there is usually no expectoration, but this is not an absolute rule. The affection may continue for weeks or months, and I have known one case in which, after lasting for years, it was followed by such severe spasm of the glottis, that tracheotomy became necessary. Generally, however, a very favorable prognosis may be given. The patient scarcely ever loses health, and the constant loud cough is often more annoying to the family than it is to the individual affected. The most certain means of curing this troublesome affection is afforded by a sea voyage; but owing to the age and sex of the patient, there are often difficulties in carrying out this plan of treatment. The change and variety of scene experienced in travelling on the Continent will sometimes effect a cure, and I have known a temporary residence at the seaside prove efficacious. Where it has not been possible to get change of air for the patient, I have sometimes found satisfac-

[1] The subject of whooping-cough covers such an extensive area of pathology and therapeutics, and has been the subject of so many monographs, that, though regarding it as a neurosis in which the laryngeal nerves are largely concerned, I feel it impossible to touch on the subject in this manual. The fact that the disease is treated with considerable detail in the various text-books of medicine, makes me adopt this course with less regret than I should otherwise experience.

[2] Op. cit.

tory results follow the use of sedative or anæsthetic inhalations; but these remedies, on the other hand, are often disappointing. Laségue [1] has reported a case successfully treated by belladonna; but in a severe case that came under my care, atropine, given till its full physiological effects were produced, did not relieve the cough. Valerianate of zinc, in the form recommended in the last article, is sometimes useful.

SPASM OF THE TENSORS OF THE VOCAL CORDS.

Latin Eq.—Spasmus tensorum chordarum vocalium.
French Eq.—Spasme des tenseurs des cordes vocales.
German Eq.—Krampf der Spänner der Stimmbänder.
Italian Eq.—Spasmo dei tensori delle corde vocali.

Definition.—Spasmodic action of the tensors of the vocal cords, giving rise to a voice which is feeble, jerky, and intermittent.

Etiology.—This affection must be a very rare one, for I have only met with thirteen cases; eleven of the patients were men and two women. All were over twenty-five years of age, and all but two were more than thirty-five years. Of the men, ten were clergymen and one a barrister. The women were both compelled to speak constantly to deaf relatives.[2] In several instances the patients attributed their complaints to catching cold, and, in their cases, the onset was sudden, but in other instances the development of the affection had been very gradual. The fact that such a large number of patients were clergymen would tend to show that the affection is due to some abnormal mode of using the voice.

Symptoms.—The sound of the voice is so peculiar in these cases, that from it alone they can, as a rule, be easily diagnosed. The patient is often able to produce some notes, either in his own natural voice or in a slightly muffled tone; but whilst speaking in this way, the current of the voice seems to be partially interrupted, and the sound conveys the idea of an arrested action of the respiratory muscles. In fact, it is very much like the straining and rather suppressed voice of a person engaged in some act requiring the prolonged and steady action of the expiratory muscles (parturition, defecation). The patients often complain that they "cannot get their voice out." After speaking a word or two, or even several sentences, in this peculiar tone, the patient may again utter a few words in a comparatively healthy voice, and then may immediately relapse into the diagnostic intonation. In my experience no approach to the spasm is perceived, as long as the patient whispers, but directly the voice is sounded it becomes apparent; Schech, however, has reported a case in which the spasm occurred in a minor degree in whispering. In some cases the spasm is diminished by exertion (such as going upstairs, or walking quickly). This has appeared to me to be due to exhaustion of the expiratory muscles; but, perhaps, it may be that the quickened circulation caused by the exertion had some beneficial influence on the spasm. In one case, on the

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[1] Archives Générales. May, 1854.
[2] For details of some cases, see Hoarseness and Loss of Voice, second edition, 1868, p. 66 et seq.

other hand, exertion increased the spasm. The tense condition of the vocal cords can occasionally be perceived with the laryngoscope, but this is not always possible. Their surface, as well as that of the rest of the mucous membrane of the larynx, is usually congested. Schnitzler[1] and Schech[2] have reported cases somewhat similar to those which I have described. The latter considers that the aphonia is due both to the tense condition and the spasmodic approximation of the vocal cords. Under the head of "Stammering of the Vocal Cords," Dr. Prosser James[3] has apparently described this affection in the case of "a clergyman, who suffered from the disease in an aggravated degree, and was deeply distressed by his consciousness of the fact, that though he kept on reading the service, some of the words dropped soundless from him; a statement verified by friends who accompanied him, and assured me that his lips moved in the usual way for the utterance of words and phrases which were lost in silence."

Diagnosis.—The voice is so characteristic in these cases, that it at once distinguishes the disease.

Pathology.—I have never had an opportunity of making a post-mortem examination in a case of this disease, and it is highly probable that the pathological changes are of too subtle a character to permit of detection. The affection appears to me to be due to spasm, not only of the tensors of the vocal cords, but of all the muscles employed in expiration, especially the diaphragm. Schech regards the affection as "a co-ordinated neurosis of occupation, analogous to the cramp of writers, piano-players, and shoemakers," and thinks it is very doubtful whether the disease is central or peripheral; in the latter case, he remarks, it may be either neuropathic or myopathic.

Treatment.—After trying every kind of treatment, local and general, stimulant and sedative, I am unable to speak in favor of any method. My own patients[4] who derived temporary benefit from treatment ultimately relapsed, and I am not aware of a single example of the affection, in my own experience, in which a permanent cure was effected. In one of Schech's two cases, although the patient left him uncured, he heard that the voice was ultimately restored; the other patient was not benefited. Schech proposes as treatment, at first, absolute rest of the voice, and the constant current percutaneously, and afterward methodical vocal exercises and endolaryngeal galvanism, whilst, at the same time, galvanization of the medulla and the brain should be carried out. He recommends nervine tonics, such as arsenic, bromide of potassium, zinc, valerian, atropine, and nitrate of silver; as general tonics, quinine, iron, iodine, and cod-liver oil. In obstinate cases hydropathy, consisting in douches on the head, neck, and spinal column may be tried. Schech's experience, as far as it goes, as well as the great number and variety of remedies he recommends, tend to conclusions similar to those which I have arrived at, viz., that the disease is nearly incurable.

Chorea of the Larynx.

In addition to the various nervo-muscular affections which have been systematically considered, it is necessary briefly to refer to some conditions

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[1] Wien. Med. Presse, 1875, Nos. 20 and 23.
[2] Ueber phonischen Stimmritzenkrampf, Aertzliches Intelligenzblatt, 1879, No. 24.
[3] Lancet, Nov. 15, 1879.
[4] Op. cit.

which may occasionally be met with. Thus, it has been asserted by Geissler[1] that the laryngeal muscles are subject to choreic movements. Schreiber[2] has reported the case of a girl, aged eighteen months, who suffered periodically from St. Vitus's dance, and during these attacks uttered, with great force, sounds which followed each other very quickly, and seemed to be *quarts* or *quints*. As long ago as 1829, Dr. Serres d'Alais[3] suggested that some cases of stuttering consist in a permanent choreic affection of the tongue or lips, and it is quite possible that the larynx may sometimes participate in the morbid action at the same time, or be independently affected. Dr. Krishaber[4] has called attention to "vocal asynergy," a term which he used to imply a want of command over the laryngeal muscles, generally occurring during some form of laryngitis, but sometimes arising idiopathically. The symptoms are not, as a rule, very obvious, except in the case of singers, who find a diminished power of inflecting the voice. Schech observes that there is neither sufficient strength nor duration in the tension of the vocal cords. The patient can neither hold a tone in singing, nor say several words in succession without interruption. In singing, the sound is suddenly cut short, and in reading aloud there is such an expenditure of force that the patient soon gets tired. Schech states that Ziemssen has noticed that the action of the adductors and tensors is unsteady and even oscillating. I have myself frequently observed a tremulous action of these muscles in persons of feeble power and highly nervous organization, but I have never made any special investigation in the case of choreic patients.

MALFORMATIONS OF THE LARYNX.

Latin Eq.—Deformitates ingenitæ laryngis.
French Eq.—Vices de conformation du larynx.
German Eq.—Missbildungen des Kehlkopfes.
Italian Eq.—Vizi de conformazione della laringe.

Definition.—Congenital deviations from the normal size or form of the larynx, in adults generally consisting in the excessive smallness of the organ, and occasionally in the presence of growths or membranous webs, and more rarely of fissures. In monsters, the larynx is sometimes, but very rarely, absent; still more seldom, immensely large.

Meckel[5] observes that he is not aware of the existence of any case of complete deficiency of the larynx; but he appears to have overlooked the fact that the organ is always absent in monsters whose lungs are not developed.[6] He describes, however, a case in which the malformation consisted in extreme smallness of the larynx, the subject being a man whose testicles were only half the natural size, and whose voice was of a female character. Dupuytren[7] also found the larynx very small in a eunuch, and

[1] Geissler: Allgemeine Medicin. Central Zeitung, 1878, No. 95.
[2] Wien. Med. Blätter, 1879, No. 15.
[3] Mém. des Hôp. du Midi, 1829, p. 371.
[4] Dict. de Sc. Méd., p. 681.
[5] Handbuch der Pathol. Anat., Leipzig, 1812, vol. i. p. 482.
[6] Rokitansky: Handbuch der Pathol. Anat. New Syden. Soc. Trans., vol. iv. p. 3.
[7] Bullet. de la Soc. Phil., tome II. p. 195.

Albers[1] has reported two examples of similar undersize in monorchids. Roederer[2] observed the thyroid cartilage much below the normal size, and an entire absence of the cricoid and arytenoid cartilages in a parasitic fœtus. One case is on record[3] in which the larynx was of excessive size, being described as "a roundish oblong cartilaginous body, extending even up to the palate," a condition which the author quaintly remarks was "portentous and incurable." The epiglottis is occasionally bifurcated,[4] and sometimes redundant. The latter condition was noticed by myself[5] in a case of cleft palate in which there was also in the central line between the arytenoid cartilages a distinct fissure which extended downward on the posterior surface of the cricoid cartilage. In the case of bifurcation just referred to, the epiglottis formed two flaps which fell into the larynx, and from the first week of life gave rise to constant symptoms of laryngismus, causing death four months later. The larynx is occasionally more or less blocked up by congenital growths (see p. 220), and I have myself reported[6] one instance in which a membranous web between the vocal cords obstructed a considerable portion of the lumen of the larynx and caused persistent aphonia, till the twenty-third year, when I was enabled to remove the membrane and to restore the voice. As a rule, however, deformities of the larynx do not come within the province of treatment.

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[1] Erläuterungen zu dem Atlasse der Pathol. Anat., Bonn, 1832–47, Bd. ii. p. 103.
[2] Comm. Soc. Gott., Bd. iv. S. 136.
[3] Hoffmann: Disquisitio Corp. Human. Anatom-patholog., p. 201.
[4] Lancet, Jan. 10, 1851.
[5] Med. Times and Gaz., April 19, 1862.
[6] Trans. Path. Soc., vol. xxv. p. 35.

SECTION III.—THE TRACHEA.

ANATOMY OF THE TRACHEA.

The trachea is that portion of the air-passages which stretches downward from the larynx and terminates below by bifurcating into the right and left bronchi. Commencing at the inferior border of the cricoid cartilage opposite the lower margin of the fifth cervical vertebra (about an inch and a quarter above the vertebra prominens), it maintains its position in the middle line until it bifurcates opposite the third dorsal vertebra on a level with the interval between the second and third dorsal spines. At its upper part it is almost subcutaneous, but it gradually recedes as it descends, so that at the episternal notch it lies about an inch and three-eighths from the surface. The average length of the trachea in the adult is from four to four and a half inches, and its diameter varies from three-quarters of an inch to one inch in different specimens. Its width invariably bears a direct relation to the respiratory capacity of the lungs, being, *cæteris paribus*, greater in the male than in the female. Externally the trachea is rounded in front and on both sides, but somewhat flattened posteriorly, where the cartilaginous framework is absent; its internal configuration is of the same character, but is subject to considerable variation during life, owing to the contraction of the unstriped muscular fibres which cross the posterior part of the tube both between the ends of the cartilages and also opposite the intervals between them.

There are certain differences in the anatomical configuration and position of the bronchi and their relation to the windpipe which it is important that the practitioner should be acquainted with. The right bronchus, which is shorter and wider than the left, passes outward almost horizontally to enter the root of the right lung on a level with the body of the fourth dorsal vertebra (third dorsal spine). The left bronchus, smaller and longer than the right, runs obliquely outward and downward beneath the arch of the aorta, passes in front of the œsophagus and descending aorta, and enters the root of the lung on a level with the body of the fifth dorsal vertebra (fourth dorsal spine), *i. e.*, about an inch lower than its fellow of the opposite side. The right bronchus has rather a wider aperture than the left, and the septum between them, or "bronchial spur," is often situated to the left of the median line,[1] causing foreign bodies to fall more readily down the right than the left bronchus, notwithstanding the more oblique direction of the latter.

The trachea is in relation with a number of important structures

[1] This was first pointed out by Goodall: Stokes on Diseases of the Chest. In 100 cases examined by me during life I found the bronchial spur on the left side fifty-nine times, in the median line thirty-five times, and on the right side six times.

throughout the whole of its course. Its cervical portion is covered by the sterno-hyoid and sterno-thyroid muscles, and in the median space between them by layers of the deep cervical fascia; it is also crossed by the isthmus of the thyroid gland which usually lies on the third tracheal ring; by the arteria thyroidea ima when present, and by the inferior thyroid veins. In the same region, but more superficially, are some communicating branches between the anterior jugular veins. The innominate and left carotid arteries are also anterior to it in the episternal notch as they diverge from their origin. Laterally, this portion of the trachea is in relation with the common carotid arteries, the lateral lobes of the thyroid body, and the inferior thyroid veins, the recurrent laryngeal nerves being placed in the interval between it and the œsophagus. The thoracic portion of the trachea is covered by the manubrium sterni with the origins of the sterno-hyoid and sterno-thyroid muscles, by the left innominate vein, by the commencement of the innominate and left carotid arteries, by the transverse portion of the aorta which passes in front of it to reach the left side, by the deep cardiac plexus of nerves, and at its bifurcation by the pulmonary artery where this vessel divides into its right and left branches. Laterally it is in relation with the pleura and the pneumogastric nerves, and also on the left side with the recurrent and middle cardiac branches of the left vagus and the left carotid artery. Posteriorly throughout its whole length the trachea rests upon the œsophagus, which separates it from the longi colli muscles and the vertebral column.

The trachea is supported by a framework consisting of from fifteen to twenty incomplete rings of hyaline cartilage, which surround the tube for about three-fourths of its circumference; the remaining posterior fourth as well as the interspaces between the rings are occupied by strong bands of connective tissue and unstriped muscular fibres. Each ring is between 1½ and 2 lines in width, and on vertical section is plano-convex, the plane surface being placed externally. The rings have thus their greatest thickness at a point equidistant from their upper and lower borders, where they measure about one line from before backward. Their borders as well as their extremities are rounded off, the latter being often slightly everted. The separate segments of the tracheal framework are usually more or less fused together, two or more adjoining rings being connected for a portion of their circumference, so as to present a branching appearance. These irregularities are most frequent and striking at the upper and lower parts of the tube. The first few rings are not uncommonly welded together into an irregular plate, while the last ring is invariably of a transitional form, presenting either an incurvation or a downward projection at the point immediately above the bifurcation of the tube.

The tracheal rings are bound to each other and enclosed by two layers of connective tissue; the inner layer is of loose structure, and crowded with glands; the outer consists of firm fibrous bands running mostly in a longitudinal direction, and including a considerable proportion of elastic fibres and a few transverse muscular bundles. Posteriorly the two layers of connective tissue enclose a comparatively strong layer of unstriped muscular fibres, running transversely between the ends of the rings, to the perichondrium of which they are attached by means of small tendons; a few muscular fibres having a longitudinal direction are also met with external to the transverse fibres. The large amount of connective tissue and elastic fibres which enter into the structure of the trachea allows of that mobility which is essential in a tube subject to such constant variations in position from movements of the larynx and neck.

The internal surface of the trachea is lined by a mucous membrane which is continuous with that of the larynx, and the proper structures of which are intermingled with a considerable proportion of elastic fibres. A basement membrane bounds the mucosa, and sustains a laminated epithelium, the uppermost cells of which are columnar and ciliated. The submucosa is chiefly composed of comparatively strong bands of longitudinal elastic fibres, which freely anastomose with each other, and enclose between them the ducts of the numerous glands which lie beneath. These are most thickly distributed on the posterior wall, where they form a distinct layer between the submucosa and the muscular layer; but they also occur in considerable numbers in the interspaces between adjacent rings, and are only entirely absent in those portions of the tracheal lining which are in immediate contact with the inner convexities of the rings. The glands are of the racemose variety, lined with cylindrical epithelium.

The arteries of the trachea are mainly derived from the inferior thyroid, and form a superficial network from which venules pass to the adjacent plexuses of the thyroid veins.

The trachea derives its nervous supply from the pneumogastric and recurrent laryngeal nerves, and also from the sympathetic. Ganglionic enlargements can be traced in connection with the ultimate fibres.

Surgical Anatomy of the Laryngo-tracheal Region.

The external contour of the laryngo-tracheal region has been described at page 148. The space may be regarded as bounded on each side in the upper part by the sterno-hyoid muscles, and in the lower part by the sterno-thyroid muscles, whilst the superior border of the thyroid cartilage above and the upper edge of the sternum below, may be considered as the possible limits of the region within which the air-tube can be opened. Owing to the direction of the sterno-thyroid muscles, the space is slightly narrower below than above. It is true that an opening can be made at a higher level, *i. e.*, through the thyro-hyoid membrane; but in that case it is the pharynx which is laid bare. Division of the thyroid cartilage may also be practised, but this operation is very rarely performed, except for the removal of a body impacted in the larynx, or for the extirpation of a neoplasm which cannot be got rid of by an endolaryngeal method. Even when a foreign body is firmly fixed, however, it can almost always be dislodged through an opening in the air-passage below the level of the thyroid cartilage; and the great importance (in relation to the vocal function, of maintaining the absolute integrity of this portion of the larynx cannot be too strongly insisted on. The two operations just referred to will be found described at pp. 236 and 241, and for practical purposes we may regard the space between the lower border of the thyroid cartilage and the sixth ring of the trachea as the upper and lower limits of the tracheotomic region.

In performing tracheotomy, we cut through the skin and superficial cervical fascia (though the latter is rather a loose areolar tissue, containing more or less fat, than a distinct layer), and quickly reach the superficial layer of the deep cervical fascia; on dividing the latter structure we come upon a greater or less amount of fat and the two anterior jugular veins. In some cases the edges of the muscles on the front of the neck slightly overlap the anterior surface of the trachea, and have to be held back. Over the second, third, and fourth rings we see the isthmus of the thy-

roid gland, which, through the deep layer of the deep cervical fascia, is firmly adherent to the trachea. When these tissues have been pushed aside, we discover, adhering tightly to the front of the trachea, the deep layer of the deep cervical fascia, on division of which the tracheal rings are exposed. In dividing the trachea, it is important to remember that the mucous membrane is very closely adherent to the cartilaginous framework. In infants, the thymus gland rises half an inch above the level of the sternum, and it is frequently to be found as late as the sixth or seventh year; it may give rise to some complications by getting into the wound and obstructing the last stages of the operation. The innominate artery occasionally comes into view in "inferior" tracheotomy, and may be seen obliquely crossing the lower portion of the right half of the trachea. It is relatively higher in the child than in the adult. The left innominate vein is also often observed when the trachea is opened at a low level.

From a consideration of the vascular structures, the greater safety of opening the trachea in its upper part, that is, above the isthmus of the thyroid gland, will be readily appreciated.

The irregularities of the vessels deserve consideration, but they are rare, and even when present need not intimidate the operator. Sometimes the place of the anterior jugular vein is taken by a single central vessel, and in this case it is almost sure to be accidentally opened in performing tracheotomy. The most common irregularity of the vessels, however, consists in the presence of the thyroidea ima artery, which, when present, usually arises, from the innominate trunk, but sometimes from the right common carotid, or the aorta. More rarely it is given off from the right internal mammary or right subclavian arteries. The thyroidea ima passes to the thyroid body in the median line close to the trachea.

In performing (crico-thyroid) laryngotomy, the tissues corresponding to those described in speaking of tracheotomy are met with in the first steps of the operation, but the isthmus of the thyroid gland, of course, does not come into view; the adipose tissue is generally less abundant, and the veins much less numerous. The crico-thyroid artery, which runs across the membrane of the same name and anastomoses with its fellow of the opposite side, is a small vessel, but as Chassaignac[1] first pointed out, its place is sometimes taken by the superior thyroid trunk itself.

TRACHEOSCOPY.

The examination of the trachea with the laryngeal mirror requires more patience than laryngoscopy, and it is not always possible to obtain a view of the whole tracheal surface.[2] The general principles upon which it is conducted are much the same as those which have been laid down under "Laryngoscopy" (page 168). It is absolutely necessary, however, that the parts should be strongly illuminated, a light which is sufficient

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[1] Leçons sur la Trachéotomie, Paris, 1855, p. 9.

[2] With practice, the difficulty greatly diminishes. Thus, selecting only those cases in which the larynx could be easily seen, and the mirror readily tolerated, I was able to examine the trachea well in only 13 out of the first 100 patients; in the second 100 the examination was successful in 21 cases; in the third 100 in 29 cases; whilst in the last 116 cases the bifurcation of the trachea was seen 47 times—*i. e.*, in 40 per cent.

for laryngoscopy being often quite inadequate for tracheal examination.[1] In order to bring into view *the anterior wall of the trachea*, especially in its upper part, the ordinary laryngoscopic position answers sufficiently well, but the patient instead of inclining his head backward should hold it upright or bend it slightly forward, at the same time stretching his neck a little, but not throwing the chin up too much. He should also sit rather higher than for laryngoscopy, so that his chin is just above the level of the observer's eyes. The patient being thus placed, the operator should slowly bring the laryngeal mirror into a more or less horizontal position by lowering its anterior edge. In this movement the whole length of the anterior wall from above downward will gradually come into view. It may be added that during the change in the inclination of the mirror it is well to keep its distal margin rather further forward in the throat (*i. e.*, further away from the posterior wall of the pharynx) than in the case of laryngoscopy. *The posterior wall of the trachea* is most easily discovered by tracing the anterior wall of the trachea downward till the bronchial spur and the orifices of the bronchi become visible, when by means of a still more horizontal inclination of the mirror the lower portion of the posterior surface is brought into view. The upper third, however, is exceedingly difficult to see, and in a large number of cases altogether eludes observation.[2] *The sides of the trachea* can be easily seen by giving the mirror a slight lateral slant when the anterior wall is in the field of view. Türck[3] has pointed out that a tracheoscopic examination may sometimes be facilitated by slight external pressure of the trachea, especially in seeking the bifurcation, and he further states that it is occasionally advantageous to place the patient sideways on a chair and then to rotate his head so as to face the observer. On examining the patient in this position, parts of the trachea will often come into the field of the mirror which escape in the common method of examination, and it is not unfrequently possible to see a considerable distance down one or other of the bronchi.

When tracheotomy has been performed a small steel mirror may be introduced through the wound and a view of the canal thereby obtained, but as in these cases the disease is generally confined to the larynx, the examination of the lower part of the trachea is comparatively unfruitful.

The Tracheal Image.

The reflection of the trachea in the mirror has not the simple character of the laryngeal image. The latter is made up of a number of parts mostly situated in or near the same plane; the tracheal image, on the other hand, is the reflection of a long tract of mucous membrane seen only in perspective. Hence it is necessary briefly to describe four tracheal images, viz.: the anterior, posterior, the lateral, and the inferior.

Anterior Wall.—The appearance of the anterior wall of the trachea

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[1] It is possible that the mirror recently invented by Nitze and Leiter, of Vienna (Electro-endoskopische Instrumente: Wien., 1880), in which the electric light (contained within the mirror) is actually introduced into the pharynx, may be of use for lighting up the tracheal canal. A constant flow of cold water which passes round the mirror, and through the handle to a reservoir, keeps the glass from becoming inconveniently heated.

[2] In 17 out of 100 cases in which I was able to see the bifurcation, the upper third of the posterior wall of the trachea could not be brought into the field of vision.

[3] Klinik der Kehlkopfkrankheiten, etc., p. 92.

in the field of view depends, as already remarked, on the angle at which the mirror is held. The image is rendered very characteristic by the prominent cartilaginous rings, and the grayish red recesses between them. It varies, however, according to circumstances. Thus, in healthy persons, the color of the interspaces depends in a great measure on the degree of illumination; when the light is not very powerful, the interstices are of a dull gray color, but with a strong oxyhydrogen light they generally appear bright red. When the mirror is held so as to make an angle of 45° with the plane of the horizon, six to eight of the uppermost rings of the trachea can generally be counted; at an angle of 35° ten to twelve rings; at a smaller angle[1] the intercartilaginous spaces in the upper part are lost sight of as the result of perspective, and the corresponding rings often cannot be counted; several of the rings in the lower part of the trachea, however, now come into view, and on still further diminishing the angle of inclination the orifices of the bronchi may be perceived.

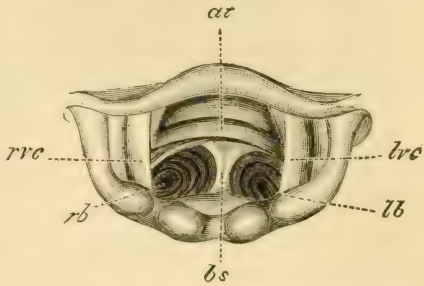

FIG. 99.—View of Anterior Wall of Trachea and Bronchi: *at*, anterior wall of trachea; *rvc*, right vocal cord; *lvc*, left vocal cord; *rb*, right bronchus; *lb*, left bronchus; *bs*, bronchial spur.

Posterior Wall.—This wall, which is of a redder color than the anterior, is often marked by transverse lines, which produce an appearance as if the cartilages actually extended across it. This effect, however, is really caused by the attachment of the ends of the cartilage to the muscular fibres at the back of the trachea, and the ridges thus produced, though apparently as close to each other as the cartilages, are really often half an inch or more apart, the intervening recesses being concealed by the perspective. In almost every examination the vertical angle on each side of the trachea (caused by the terminal joints of the cartilages) comes into view, and thus enables the observer to recognize with certainty the part he is inspecting.

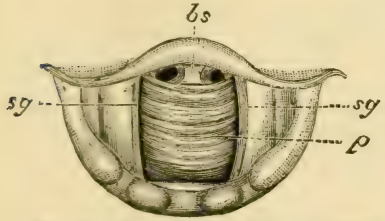

FIG. 100.—View of Posterior Wall of Trachea and Bronchi: *bs*, bronchial spur; *sg*, subglottic region; *p*, posterior wall of trachea.

Lateral Walls.—In these images the rings of the trachea can be very distinctly seen, as well as the vertical angle on each side, already referred to.

Inferior Wall.—The reflection of this portion of the trachea includes the bronchial spur and the orifices of the bronchi, and sometimes even from half an inch to an inch of the upper part of those canals. The spur, it must be remembered, is generally placed slightly to the left of the median line, so that if the mirror is held exactly at right angles to the central plane of the body, the observer can see down the right but not down the left bronchus. In connection with the image of the inferior wall it is necessary to notice the tracheal pulsation, a phenomenon which is most distinctly seen

[1] These angles are based on the supposition that the patient and observer occupy the exact positions described. It is, of course, obvious that the slightest change of situation will alter all the relations.

by watching the bronchial spur, and to which both Gerhardt[1] and Schroetter[2] have called attention. The pulsation corresponds to the cardiac systole, and appears to be due to the position of the windpipe between the aorta and the innominate artery. It can be seen most distinctly when the capillaries of the mucous membrane covering the spur are engorged.[3] I was able to observe it in forty-one per cent. of the cases in which the bronchial spur was visible. In twenty-three cases the bronchial spur was directed to the right side; in the remaining eleven cases, although pulsation could be perceived, the exact nature of the movement could not be accurately distinguished.

TRACHEAL INSTRUMENTS.

Brushes, Forceps, etc.—The various laryngeal instruments already described (page 178 et seq.) can be employed in treating diseases of the trachea, but the brushes and sponge-holders, if used, require to be longer below the angle. In tracheal affections insufflators are of great service, the same instruments being applicable for the purpose as those recommended for the larynx. The inhalations and sprays already described also answer equally well for the trachea. The common laryngeal forceps, however, can seldom be introduced into the windpipe, though the tube-forceps (page 190) will be found useful in extracting a foreign body, especially through an opening in the trachea.

The Solid Atomizer.—An instrument has lately been invented by Mr. Bell, of Newcastle-on-Tyne, which promises to be of great value in the treatment of tracheal affections. It consists of a small metal chamber, containing a very finely reduced medicated powder, which is kept in constant movement by the revolution of four little fans acting by clockwork. By an ingenious contrivance the powder is delivered at longer or shorter intervals of time at the will of the operator. By the aid of this instrument, medicated powders can be easily introduced, not only into the trachea, but into the ultimate bronchi and pulmonary cells.

Galvanic Cautery.—The use of galvanic cautery in endolaryngeal operations was recommended in 1854 in his very first communication on the subject[4] by the actual inventor of this surgical method, the late Professor Middledorpf, of Breslau. But although he even reported a case in which he had removed, *per vias naturales*, a growth probably originating from the right ary-epiglottic fold, yet as the growth appeared at the back of the mouth, the operation can scarcely be considered as endolaryngeal, and the merit of having first removed a neoplasm from the larynx by electric cautery remains with v. Bruns, who had also been the first to apply the laryngoscope in the operative treatment of this disease by simpler methods. In the year 1864 v. Bruns operated successfully with galvanic cautery on two patients[5] suffering from laryngeal polypus; and in the same

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[1] D. Archiv f. Klin. Med., Bd. ii. p. 543.
[2] Sitz. d. k. k. Akad. d. Wiss., Bd. lxvi., 1872.
[3] Ibid.
[4] Die Galvanocaustik: Ein Beitrag zur operativen Chirurgie, Breslau, 1854, p. 212 et seq.
[5] Laryngoscopie und Laryngoscopische Chirurgie, Tübingen, 1866, pp. 367 and 398.

year Professor Voltolini, of Breslau, employed galvanic cautery in some endolaryngeal operation.[1] In 1866 and 1867 I operated on several cases [2] by this method. It is mainly to the enthusiastic exertions of Voltolini that the profession is indebted for the application of galvanic cautery to the treatment of laryngeal neoplasms; but in spite of his recommendation,[3] and notwithstanding the numerous improvements which have since been made in batteries and instruments,[4] the galvano-caustic method has not hitherto come into general use for treating the larynx.

I have already stated at some length [5] my reasons for not recommending galvanic cautery for the destruction of *laryngeal* growths, the essential grounds of my objection to this method being that it requires the use of an exceedingly complicated apparatus where a simple one is equally efficacious. I now very rarely employ it except in the case of subglottic neoplasms. Schech [6] thinks that "hardness of consistency and vascularity of structure" are amongst the conditions which especially call for galvanic cautery, and in one case,[7] in which the growth was very dense, I found this method useful. With regard to the other point I can only say that I have operated successfully on the most vascular neoplasms [8] with common cutting forceps without any evil results, and therefore do not see the necessity of galvanic cautery in such cases. It appears to me that it is only in cases of small growths situated in the upper part of the trachea that this method of extirpation is especially indicated. It is difficult to make use of the forceps in such cases, and an instrument in which the destructive process is effected by mere contact appears particularly indicated.

Galvanic cautery is also very useful for destroying enlarged veins, whether situated in the pharynx or larynx, and I have employed it for this purpose for many years. It has been recommended with the same object by Mr. Lennox Browne [9] in obstinate cases of chronic pharyngitis. For destroying nasal polypi galvanic cautery was first recommended by Voltolini, and it has since been successfully employed in treating this class of affections by Drs. Thudichum, Michel, Browne, Semon, and myself. The method has also been used in performing tracheotomy (see "Bronchotomy"), but for this purpose it is not likely to come into vogue. Lastly, I have employed galvanic cautery with success in some cases of fibrous goître. The application of this method will be again referred to in dealing with the various diseases in which its use has been indicated.

Galvanic cautery batteries may be conveniently divided into two classes, viz., those which require two different acids (nitric acid and dilute sulphuric acid), with a porous intervening cell, and those which re-

[1] Die Anwendung der Galvanocaustik, etc., Wien, 1871, p. 143 et seq.
[2] Growths in the Larynx, pp. 144–5.
[3] Op. cit. p. 25.
[4] In addition to the works already referred to, see v. Bruns: Die Galvano-Chirurgie, etc., Tübingen, 1870; Schnitzler: Laryngologische Mittheilungen, Wiener Medizin. Presse, 1866–78; Böcker: Ein Handgriff zur Anwendung der Galvanocaustik, etc.; Berl. Klin. Wochenschrift, 1873, Nro. 30.
[5] Growths in the Larynx, pp. 82 and 83.
[6] Die Galvanocaustik, etc., Aerztliches Intelligenzblatt, 1877, Nro. 43 and 44.
[7] Growths in the Larynx, Case 49.
[8] Ibid., Case 89.
[9] The Throat and its Diseases, p. 102.

quire only one solution. Of the former kind the best is perhaps that of Grove;[1] of the latter, Grenet's[2] battery, in which a single fluid—a mixture of bichromate of potash and sulphuric acid—is used, with two metals, is the type. Although for large operations, such as the removal of the breast or tongue, where a uniform and somewhat prolonged action is required, batteries on Grove's principle should always be employed; for minor operations on the larynx, trachea, and nose, some modification of Grenet's instrument will be found to answer perfectly well. The most convenient

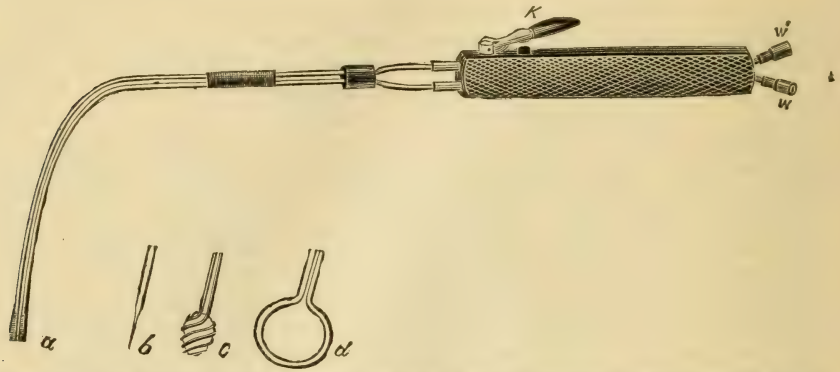

FIG. 101.—The Galvanic Cautery Electrode: *k*, the key by which the current is established: *w* and *w'*, metal tubes which receive the wires of the battery; *a*, the flat side of the ordinary galvanic cautery point; *b*, the same seen in profile, one-third of size; *c*, another form of galvanic cautery point; *d*, loop used in connection with an écraseur similar to that described at page 192.

instrument of the kind is that of Dr. Dawson,[3] of New York, but I can strongly recommend Leiter's,[4] which the practitioner, without touching the exciting fluid, can charge and uncharge by pressure on a little india-rubber ball.

Whichever battery is used, there should be as few breaks as possible in the conducting apparatus.[5] The points which I most frequently employ are shown in Fig. 101. In dealing with pharyngeal and nasal polypi

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[1] Bunsen's modification of Grove's battery in which the sheet of platinum is replaced by a cylinder of carbon is also an excellent instrument, and is less expensive than Grove's.

[2] Smee's battery, which consists of a platinized sheet of silver placed between two vertical plates of zinc, and immersed in a single fluid (dilute sulphuric acid), answers extremely well for electric cautery, but it is more expensive and less manageable than Grenet's instrument.

[3] This battery is composed of two cells, each of which contains three zinc and two platinum plates, measuring 4½ by 6 inches. The zinc plates are perforated and fixed half an inch apart, and a platinum plate is held in position between them by means of uprights. On each side of the platinum plates are hard rubber pumps, which, when worked up and down by means of a small handle, drive the exhausted fluid away and allow fresh fluid to come in contact with the plates. A power equal in intensity to that obtained from large batteries is thus secured; but the pumps do not require to be used in laryngeal and nasal operations. The entire battery measures 8½ inches in height, 6 inches in width, and 4 inches in depth, and only requires two and a half pints of the ordinary mixture of bichromate of potash and sulphuric acid.

[4] Sold by Krohne, Duke Street, Portman Square.

[5] I formerly used thick conducting wires covered with gutta-percha, but afterward, for a time, I employed fine wires in order to facilitate the manipulation of the instrument. I have returned to thick wires for the sake of improved conduction, and by resting the wires on my right shoulder I contrive that a very small portion should hang on the instrument.

I have occasionally used galvanic snares with a handle similar to that figured on page 192,[1] but I have not found that cautery can be conveniently carried out in the larynx or trachea with this form of apparatus. Instruments of very delicate construction have been made under Dr. Schech's[2] direction, but I have never used them myself.

Tracheotomy Instruments.

The Ordinary Canula.—As will be hereafter shown in dealing with the history of the subject, the tracheal canula has undergone various modifications since it was first invented. The instrument commonly employed consists of a silver tube, the curve of which corresponds to the arc of a quadrant. It is introduced into the trachea in such a way that the larger end of the instrument looks directly forward and projects a little from the surface of the wound, and it is prevented from falling into the windpipe by means of a transverse collar, or shield, articulated to it by a joint which permits of considerable play between the two portions of the instrument. The ends of the shield slant slightly backward so as to correspond with the curve of the neck, and each is perforated by a large oval opening (Fig. 104, *t*) for the tapes,[3] by means of which the instrument is held in place. The lower extremity of the tube is directed downward and its axis should correspond with the long axis of the trachea. In order to facilitate introduction, the canula is, or ought to be, fitted with

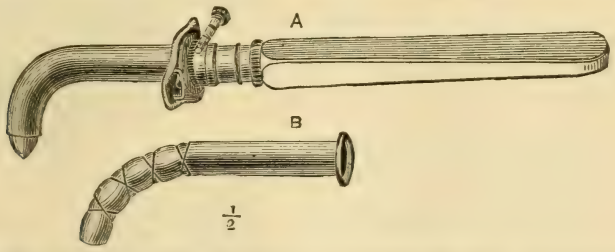

Fig. 102.—Durham's Right-angled Canula: A, the canula, with pilot; B, the inner tube.

a pilot consisting of three portions, viz., a firm handle, a shank which passes down the canula, and a conical end which projects from the distal extremity of the canula when the instrument is prepared for use. The canula is also provided with an inner tube which can be easily removed and cleaned, and should be a little longer than the canula proper (Fig. 103) so as to provide against the accumulation of mucus. To prevent its being forced out by coughing, the inner tube can be bolted to the shield.

Durham's Canula.—The principal objection to the tube just described is that, from the nature of its curve, it often irritates or even cuts into the anterior wall of the trachea, and in inventing the right-angled tube with its long horizontal and short vertical portions, Mr. Durham[4] has made a very important advance in this department of mechanical surgery.

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[1] Manufactured by Mayer & Meltzer.

[2] Sold by Albrecht, surgical instrument maker, at Tübingen.

[3] In most of the English instruments there is only a narrow vertical slit, through which it is often very difficult to pass the tapes.

[4] The Practitioner, April, 1869.

Other improvements have also been introduced into the instrument.[1] It has already been pointed out that the depth of the trachea from the surface varies in different parts of its course (page 364), but its position also depends on the condition of the neck—whether it is thin or fat, normal or swollen. To meet these varying conditions, in Durham's instrument, that part of the horizontal portion of the canula which passes into the neck can be shortened or lengthened, and fixed to the shield in the desired position by means of a screw (Fig. 103, *sc*). This screw arrangement for varying the length of the tube, is, of course, only required for the temporary canula, and may be dispensed with when a permanent tube is inserted. The anterior extremity of the canula proper should, in all cases, project about a centimetre in front of the shield, and the anterior extremity of the inner tube should have a little projecting ridge by which it can be easily taken hold of. This arrangement is much more convenient than that of the older tubes in which the orifice of the canula is flush with the shield, and wire loops have to be attached to the inner canula in order to admit of its removal; for these loops are apt to get in the way when the patient desires to close the tube with his finger for speaking. Owing to the shape of the canula in Durham's instrument, the inner tube seldom requires to be fixed, as in the common canula; but if special security is necessary, the permanent tube can be provided with a little bolt (Fig. 104, *b*), which is much more convenient than the clumsy arrangement of the common instrument. The angular and descending portions of the inner

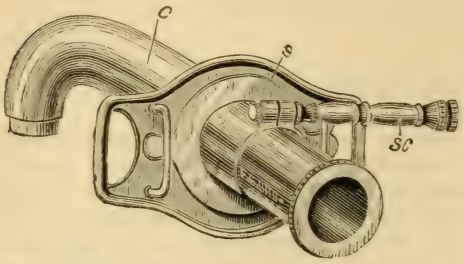

FIG. 103.—The Temporary Right-angled Canula (Durham's): *c*, the transverse portion of the canula, which can be pushed a short or longer distance through the shield *s*, and then fixed by the screw *sc*.

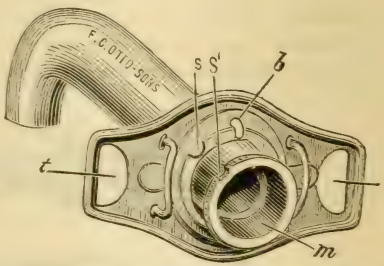

FIG. 104.—The Permanent Right-angled Canula (Durham's, slightly modified): *m*, mouth of inner tube; *b*, bolt which fixes in inner tube; *s*, slot, which, when turned round opposite to *b*, unlocks the bolt, and enables the canula to be withdrawn; *s'*, slit at orifice of mouthpiece of inner canula, which exactly corresponds in position and moves with *s*. From its superficial position, *s'* can be easily felt, and the patient or practitioner can readily guide the inner tube into the desired position, whether for the purpose of introduction or removal.

[1] On the ground that the trachea is not placed vertically in the neck, but slants backward as it descends, Mr. R. W. Parker (Med.-Chir. Trans., vol. lxii., 1879) recommends that the tracheotomy-tube should be made at an obtuse angle. In cases of stenosis, where a very long tube has to remain in the trachea, Mr. Parker's suggestion may be of use, but even in these cases König's tube see "flexible canula") would most probably be found more convenient. In ordinary cases the rectangular tube answers perfectly well, the extreme shortness of its descending portion reducing the backward inclination of the trachea to a matter of no importance. In order to introduce Mr. Parker's tube into the throat without hurting the patient, it is necessary to use a pilot, similar to that supplied with Mr. Durham's instrument; but for the purpose of permitting the introduction of the inner tube without employing lobster-joints, Mr. Parker has the angular portion and contiguous parts of the upper surface of his inner tube cut away. It need scarcely be pointed out that this arrangement greatly diminishes the value of the inner tube, as the secretions come in contact with a large surface of the outer canula.

tube of the right-angled canula, as well as the corresponding portion of the pilot, have to be made with joints on the lobster-tail principle. A set of tracheotomy tubes should contain four sizes, with the following diameters: No. 1, one centimetre; No. 2, nine millimetres; No. 3, seven millimetres; No. 4, five millimetres. The length of the tubes should be respectively seven centimetres, six centimetres, five centimetres, and four centimetres. These lengths, however, mainly depend on variations in the length of the horizontal position, the vertical part being only from half an inch to three-quarters of an inch in length. Owing to the shape of the tubes, Durham's instrument remains in the long axis of the trachea, and should be fixed in a central position so that it does not touch the walls of that canal. The only argument that has been alleged against its use is, that mucus gets easily attached to the joints of the inner tube, and that the joints themselves are apt to become corroded. As regards the former complaint, I have not found it worthy of any serious consideration, but no doubt the condition of the joints ought to be frequently and carefully inspected.

Fuller's Canula.—In an instrument devised by the late Dr. Fuller,[1] a slip of about one-eighth of an inch in diameter is removed from both the upper and lower walls of the tube, the two lateral portions remaining. These are kept in place by being attached to the collar. By holding the two sides of the tube tightly together, the size of the instrument is greatly diminished, and its extremity reduced to a mere point, which can be very easily introduced into the windpipe. The inner tube, which is afterward passed in, separates the outer segments and the whole becomes compact.

Gendron's Canula.—Gendron[2] has invented a somewhat similar instrument, the tracheal tube consisting of two segments of a canula which are separated after introduction into the throat by means of a screw on a transverse bar.

I do not, however, recommend either Fuller's or Gendron's instruments, for they cannot be so easily introduced as the rectangular tube when provided with a good pilot; the projecting edges of the outer tube are also very apt to cause ulceration, and from the canula and shield having a fixed union the instrument is much more uncomfortable to wear.

Hard India-rubber Canula.—I have occasionally used vulcanite tubes, but I am not aware that they possess any advantage over silver ones, and they are open to the objection that they have to be made considerably thicker than the latter; thus, with the same external diameter, the lumen of the vulcanite tube is smaller. They are also much more likely to break, and hence I do not consider their employment to be altogether devoid of danger.

Soft India-rubber Canula.—These tubes were first introduced by Mr. Morrant Baker.[3] They are not recommended for use until a few days after the operation, when they are said to be more comfortable to the patient than tubes of a more rigid construction. On the ground of thickness they are open to the same objection as the vulcanite instruments, and they do not permit the use of an inner tube. They, therefore, have to be removed rather frequently, and are thus likely to lead to irritation of the tracheal wound.

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[1] Trans. Med.-Chir. Soc., vol. xl. p. 69 et seq.
[2] Linhart: Operationslehre, 2d ed. p. 652.
[3] Trans. Med.-Chir. Soc., vol. lx. p. 71.

Flexible Metal Canula.—In cases of compression of the trachea from goitre or other tumors, it is sometimes necessary to use a very long tube, and under these circumstances a canula which is flexible, but yet sufficiently rigid to resist pressure, is most suitable. In König's[1] tube the curved portion is like an ordinary canula, the upper three inches of the descending part is made of silver wire spirally twisted, and the lowest inch is again a solid tube. This canula has answered its purpose in several cases.

Pocket Canula.—To meet the emergency of sudden suffocation,[2] my pocket canula will be found very convenient. It consists of a medium-sized tracheal canula with a hollow pilot or key, which contains a scalpel.

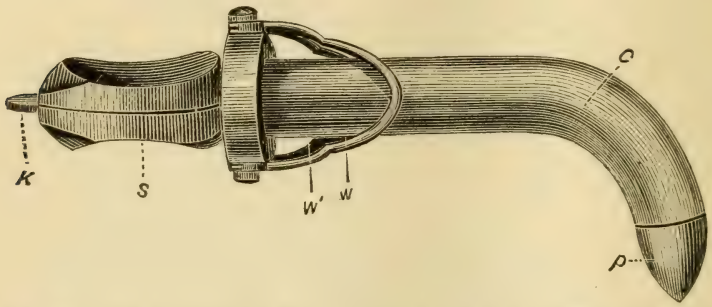

FIG. 105.—The Pocket Canula (largest size): *c*, canula; *w* and *w'*, wings, which, when not in use, lie flat against the canula, but which, when ready for service, are brought forward and form the shield; *p*, pilot, projecting from extremity of canula; *k*, knife, projecting from handle, in order that it may be more easily withdrawn; *s*, slit in handle, showing how it opens when withdrawn from the canula.

The shield is made of two pieces of stout wire, which, when the instrument is not in use, bend backward against the sides of the tube. The whole instrument is so small and compact that it can be easily carried in the waistcoat pocket.

Other Tracheotomy Instruments.—For performing tracheotomy, a scalpel, a blunt-pointed bistoury, common dissecting forceps, a tenaculum, a pair of ordinary retractors, bone-cutting forceps, and elastic retractors are required. It is only the last named instruments that demand a brief description; the various accessory appliances which may be necessary during the operation will be hereafter mentioned in speaking of the operation itself.

Elastic Retractors.—These consist of two pieces of silver wire formed like retractors, with shanks only an inch and a half long, connected to-

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[1] Max Schüller: Tracheotomie, Laryngotomie, and Exstirpation des Kehlkopfes. Deutsche Chirurgie, 1880, pp. 90 and 91.

[2] Some years ago I was called to a gentleman in the immediate neighborhood of my house, but knew nothing about the case until I arrived. Finding that there was considerable œdema, I returned home for my tracheotomy instruments; but though only absent for a few minutes, I found, on my return, that he had ceased to breathe. I at once performed tracheotomy, and by means of artificial respiration the patient was restored to full consciousness and apparent vigor; but he died thirty-six hours later, and at the post-mortem examination it was discovered that one lung was completely collapsed, a condition which must have arisen when the breathing was temporarily suspended. Since that time I have always endeavored to carry about with me instruments for instantly performing tracheotomy.

gether by a piece of elastic tape about ten inches in length. One retractor is first introduced into the side of the wound, the elastic is then passed round the neck, and the other retractor introduced. These retractors are

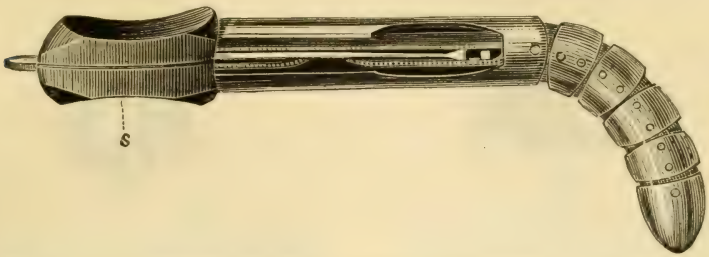

FIG. 106.—Pilot, showing its Hollow Construction and the contained Knife: *s*, slit, which opens to permit the removal of knife.

useful when tracheotomy is performed for the removal of a foreign body, as an assistant holding the ordinary retractors is often in the way of the operator. They are employed in Germany in Bose's operation (p. 407).

ACCESSORY INSTRUMENTS USED IN CONNECTION WITH TRACHEAL CANULÆ.

Trendelenburg's Tampon-canula.—This is an instrument intended for blocking up the space between the canula and the wall of the trachea, and thus preventing blood passing into the lungs in the case of operations on the larynx or pharynx, likely to be attended with serious hemorrhage. The instrument was originally invented by Dr. Trendelenburg, but has since been improved by Drs. Semon[1] and Beschorner.[2] It consists of an ordinary tracheotomy tube with a broad groove running round its lower extremity externally. This groove receives a hollow india-rubber air-belt, which, when uninflated, is flush with the surface of the canula. A fine capillary silver tube, soldered *inside*[3] the canula, communicates at one end with the air-belt, and at the other opens near the anterior orifice of the canula. To this extremity is attached a piece of elastic tubing about six inches in length, with a stop-cock at its free end. The canula having been introduced into the trachea, the belt is inflated by means of the tube, and the stop-cock turned off. The expansion of the belt blocks up the space between the canula and the walls of the trachea, and thus renders it impossible for any blood to pass from the larynx into the air-passages. It is very important not to fill the air-belt too full,

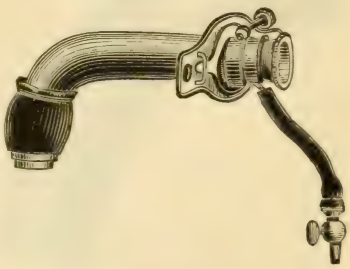

FIG. 107.—Semon's Modification of Trendelenburg's Tampon-canula.

[1] Monatsschrift für Ohrenheilkunde, etc., 1879, No. 6.

[2] Deutsche Zeitschrift für Chirurgie, 1872, p. 466.

[3] In Trendelenburg's original instrument, the capillary tube was soldered to the *outside* of the canula, and rendered the latter very difficult of introduction. Dr. Semon's improvement consists in placing the fine tube within the canula.

as much pressure suddenly applied to the trachea is apt to produce an asthmatic paroxysm. I have seen this accident occur on two occasions.

Tracheal Valves.—In cases where the canula has to be worn for some months, the patient's comfort may sometimes be promoted by the applica-

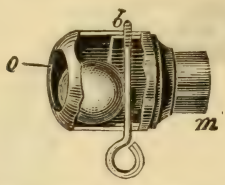

FIG. 108.—Luer's Valve, seen in section: *o*, orifice; *m'*, mouth, which fits into *m* in FIG. 104; *b*, bolt, which prevents the small silver ball passing beyond the containing box.

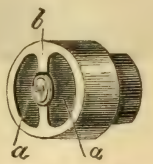

FIG. 109.—Smith's valve, slightly modified: *a*, india-rubber valves, which can be drawn in, but not forced outward; *b*, bar by which the valves are secured.

tion of a valve to its mouth, which admits the ingress of air, but closes the tube when the patient expires. The primary object of these valves is to enable the patient to speak without stopping the mouth of the canula with his finger, but they also greatly facilitate coughing and favor expectoration. Various kinds of valves have been devised. The first was that of Luer (Fig. 108), in which a small chamber containing a small ball is fitted into the mouth of the canula. When the patient speaks the pea is driven forward and blocks up the anterior opening, whilst on inspiration it falls into the cavity of the containing box, and allows the air to enter the windpipe. The noise of the pea rattling in its chamber is annoying to some patients, and Mr. Thomas Smith[1] has invented a valve consisting of a little silver box with an india-rubber flap, permitting inspiration but closing the canula on expiration and vocalization. In this instrument the india-rubber valve is apt to be forcibly coughed out, and lately a somewhat similar valve (Fig. 109) has been made in which the flap is supported by a fine central bar which diminishes the tendency to its forcible eversion. It must not be forgotten that all these mechanical contrivances for assisting in speaking diminish the supply of air, and hence they should not be used during sleep or where any exertion has to be made.

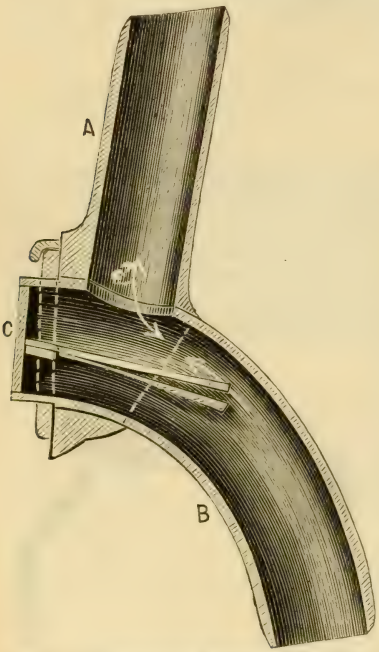

FIG. 110.—Dr. Foulis' Modification of Gussenbauer's Vocal Apparatus: A, the upper tube; B, the lower tube; C, the reed.

Artificial Vocal Apparatus.—When the greater part of the larynx has been removed, vocalization can be assisted by the introduction of a vibrating-reed. The first instrument of this kind was devised by Gussen-

[1] Trans. Med.-Chir. Soc., vol. xlviii.

bauer,[1] but it has been considerably improved by Dr. Foulis.[2] It consists of two tubes, or, in other words, of the ordinary tracheal canula and an ascending branch. The latter is introduced first, and through its mouth the descending branch or ordinary canula is passed. Into a groove in the lower tube is slipped a reed, the vibrating edge of which is directed downward in the long axis of the tube and reaches rather more than an inch from the external orifice of the instrument. The reed is free, and runs in a little groove in the side of the canula. Professor Heine has added a screw mechanism to the reed, so that it can be turned on one side when the patient is not speaking—an arrangement which permits a more abundant supply of air during ordinary respiration. In Gussenbauer's original instrument the descending portion was introduced first. This arrangement, however, was finally discarded, the subsequent introduction of the upper tube being found extremely difficult. It may be added that in the first instrument the reed was enclosed in a separate case.

ACUTE CATARRHAL TRACHEITIS.

Latin Eq.—Tracheitis acuta catarrhalis.
French Eq.—Trachéite catarrhale.
German Eq.—Akuter Trachealkatarrh.
Italian Eq.—Catarro acuto della trachea.

Definition.—Acute catarrhal inflammation of the lining membrane of the trachea, very seldom dangerous to life, characterized by cough and increased secretion of mucus, and commonly associated with a similar affection of the bronchi and larynx.

Etiology.—Under this head it is only necessary to refer to the causes of the catarrhal laryngitis (page 195).

Symptoms.—The disease is generally very slight, except when the inflammation at the same time affects the larynx and bronchial tubes, under which circumstances the tracheal affection is apt to be overlooked. Cases, however, occasionally occur in which the inflammation is limited to the trachea, and it is then sometimes severe. In ordinary cases, only a slight irritation, or a tickling sensation with a hacking cough, is experienced, but in a few cases I have observed a frequent violent and paroxysmal cough. Owing to the large calibre of the tracheal canal in relation to that of the larynx, considerable swelling of the mucous membrane may take place without giving rise to any dyspnœa. The expectoration is generally more abundant than when the larynx alone is affected, but much less copious than when the inflammation at the same time involves the bronchial tubes. On making a tracheoscopic examination the mucous membrane can be seen to be hyperæmic. Generally it is bright red, but occasionally it has a purple tinge; and in rare cases one or more ulcers may be perceived. When present they are usually situated on the intercartilaginous portions of the trachea; they are seldom larger than two millimetres in diameter, but I have once seen a catarrhal ulcer a centimetre in length

[1] Arch. Klin. Chir., 1874, bd. 17, p. 349.

[2] Lancet, Jan. 26, 1878.

and half that size in breadth. Patches of mucus are not unfrequently seen adhering to the mucous membrane, and as they often remain in the same position for several days, they are apt to be mistaken for ulcers. With a firm short-haired brush, however, they can generally be dislodged. Twice I have known acute congestion of its lining membrane to be associated with *spasmodic contraction of the trachea*,[1] but in what relations the two conditions stood to each other I am unable to state. In both cases the symptoms to some extent simulated asthma. One case is on record [2] in which acute laryngo-tracheal inflammation was followed by inflammatory thickening of the lining membrane of the trachea and by the formation of a plastic deposit which underwent some degree of development. "The structure was soft, tough, and fibrous, like pretty firm pleuritic adhesions." Tracheotomy was attempted, but owing to the density of the tracheal obstruction the canula could not be inserted until the excision was extended into the larynx. The patient died a few days afterward from the *subsequent* supervention of diphtheria. The course of the tracheal affection, from the time the symptoms commenced until diphtheria developed, was only about thirty days. The original tracheal inflammation was preceded by an attack of measles, and was complicated by interstitial pneumonia.

When the laryngoscope cannot be used, information may sometimes be obtained by the stethoscope, mucous râles being often heard over the windpipe. Dr. Hyde Salter [3] formerly published some interesting papers to show that dysphagia is a symptom of tracheitis. He pointed out that whilst the lower extremity of the trachea is fixed, the upper extremity moves upward with the larynx in swallowing, and hence, if the lining membrane of the tube is much inflamed, considerable pain is experienced in deglutition. It is characteristic of tracheal dysphagia, according to Dr. Salter, that the pain is most severe when the elevators of the larynx can act most vigorously in deglutition, that is, when the chin is raised, whereas if the chin is pressed against the neck so that these muscles cannot contract with force, little or no pain is experienced in swallowing. In the four cases brought forward in support of these views there were no symptoms of laryngeal inflammation, but, unfortunately, the laryngoscope was not used. Whilst attaching the greatest importance to the opinion of this excellent clinical observer, I think it right to state that although I have watched for this symptom I have never yet met with it.

Diagnosis.—In respiratory diseases, accompanied with cough and expectoration, the question whether the trachea is involved can only be determined with certainty by the aid of the laryngoscope.

Prognosis.—Simple inflammation, when limited to the mucous lining of the trachea, is almost devoid of gravity, and beyond the symptoms of cough and expectoration for a week or two no trouble need be apprehended.

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[1] Little is known of spasm of the trachea, which must be a very rare affection. Porter (Surgical Pathology of the Larynx) cites an example from the Edinburgh Medical Journal, in which, after death, an annular contraction of the central portion of the trachea was discovered. This contraction passed off on the following day. I have not, however, been able to find the case in the journal quoted by Porter. Dr. Scott Allison (Morbid Conditions of the Throat and Consumption, 1867) has also described the condition, and Dr. Prosser James (Sore Throat, 3d edition, p. 260), to whom I am indebted for the above references, recognizes two forms of spasm, one allied to laryngismus stridulus and the other to asthma.

[2] Dr. Andrew Smith: Amer. Journ. of Med. Sci., July, 1876.

[3] Lancet, vol. ii. 1864, pp. 7 and 88.

Treatment.—The majority of cases of simple tracheitis scarcely call for any therapeutic measures. Confinement in a uniform temperature, a light diet, and gentle purgation, generally soon affect restoration. When the cough is troublesome, however, insufflations of morphia (gr. $\frac{1}{16}$ to gr. $\frac{1}{8}$), once or twice a day, are often of great service. If morphia disagrees, bismuth (gr. $\frac{1}{4}$ to $\frac{1}{8}$) with starch or gum (gr. $\frac{1}{2}$), administered by the same method, often gives relief. In order to hasten the cure a mixture containing some expectorant, such as squills or ipecacuanha, may be given, whilst sinapisms may at the same time be applied *not directly over the trachea* in the neck, but over the upper part of the sternum. Considerable benefit may also be derived from the employment of hot soothing inhalations (such as the vapor benzoini or the vapor lupuli of the Throat Hospital Pharmacopœia). Should the mucous secretion be too abundant it may be restrained by the use of stimulating inhalations of pine oil or creasote. After an attack of tracheitis the patient should of course observe more caution in returning to his usual avocations, and in cold and unsettled weather a respirator should always be worn by those who are subject to this affection. The prophylaxis recommended in laryngitis (page 200) is also sometimes required.

Chronic Tracheitis.

This affection occasionally remains as a sequel to the acute affection, and it is an almost invariable accompaniment of the chronic bronchitis of old people. In itself it does not give rise to much inconvenience, nor is it attended with any serious danger. Balsamic inhalations generally give relief. In exceedingly rare cases thickening of the walls of the trachea may result from long-standing inflammation of a simple character; but in the whole range of medical literature, I only know of six cases in which this has occurred, viz., one reported by each of the following observers—Andral,[1] Gintrac,[2] Cyr,[3] Gibb,[4] and two by Wilks.[5] It is highly probable, moreover, that even in some of these cases syphilis was really the cause of the disease. The treatment for such cases is laid down under "Stricture of the Trachea."

NON-MALIGNANT TUMORS IN THE TRACHEA.

(Synonyms: Benign Growths. Polypi.)

Latin Eq.—Polypi tracheæ.
French Eq.—Polypes de la trachée.
German Eq.—Trachealpolypen.
Italian Eq.—Polypi della trachea.

Definition.—Neoplasms of benign character forming projections on the mucous membrane of the trachea, and when large giving rise to severe dyspnœa.

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[1] Clinique Méd., 1834, 3d ed. t. iii. p. 183.
[2] Bull. Méd. de Bordeaux, Juin, 1844.
[3] Des Rétrécissements de la Trachée, Thèse de Paris, 1866.
[4] Op. cit. p. 391.
[5] Guy's Hospital Reports, 1863.

Etiology.—The etiology of tracheal polypi is similar to that described under the corresponding laryngeal affection (page 220), with the exception that the trachea, being much less liable to irritation than the larynx, is correspondingly less predisposed to the formation of growths. This will be readily understood when one considers that the trachea is a smooth canal whose functions are nearly passive, whereas the larynx, on the other hand, presents numerous irregularities and is composed of parts which are in constant movement. A few cases, however, of benign growths in the trachea have been recorded by Türck,[1] Gibb,[2] Fifield,[3] and Störk,[4] and I have myself met with four examples of the disease.

Symptoms.—The characteristic symptom of the disease is dyspnœa—its degree depending on the size of the growth and probably also on the rapidity of its development. In one of my cases the patient died from suffocation after refusing tracheotomy. In Türck's case of fibroma, however, the growth attained a very considerable size without giving rise to any serious dyspnœa; and the same remark applies to Schroetter's case of sarcoma (see page 387). In three of my cases the voice was hoarse or weak, but in one instance, though the neoplasm was large (Case 4), the voice was not at all affected. There is generally a good deal of irritation of the windpipe and some expectoration. With the laryngoscope the neoplasm can often be brought into view. Generalizing from my own few cases and the scanty records of others, the growths are usually of a papillary or cauliflower appearance; sometimes, however, they are smooth, and occasionally have a semi-transparent aspect, as in Gibb's case. In some cases they are pedunculated, but generally they are sessile.

Pathology.—In three of my cases the rough, uneven surface of the growths led me to think that the tumors were papillomata; the remaining case had the appearance of a fibroma. Türck [5] described his case as a roundish hard fibroma growing from the posterior wall of the upper part of the trachea and reducing the canal to the shape of a crescent. At the corresponding situation, but extending backward, was a smaller, more pedunculated, round tumor growing into the œsophagus. In Fifield's case, the growth, which was about the size of a small grape, was attached to the lower part of the trachea and covered the mouth of the left bronchus. It was described as "quite soft, of whitish color, and of fleshy and probably fibrous character."

Diagnosis.—Tracheal polypi can only be diagnosed with certainty by means of the laryngoscope. In order to eliminate the chance of a syphilitic stricture, it is very important to ascertain the patient's history. Nor must the possibility of the existence of that very rare affection, cancer of the trachea, be forgotten. The extension of cancer from the gullet to the trachea is easily recognized by the previous œsophageal symptoms. Türck's case [6] of fibroma, however, shows that there may be benign growths common to both the gullet and the trachea. Dr. Solis Cohen [7] points out that tumors in the subglottic region of the larynx are very apt to be mistaken for tracheal growths, and with this observation I entirely concur.

Prognosis.—Although the histories of the few cases of tracheal growth

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[1] Op. cit. p. 502.
[2] Op. cit. p. 392.
[3] Boston Med. and Surg. Journ., November 14, 1861. Cited by Cohen, loc. cit. p. 578.
[4] Klinik der Krankheiten des Kehlkopfes, p. 438 et seq.
[5] Op. cit. p. 502.
[6] Op. cit.
[7] Op. cit. p. 576.

with which I am acquainted do not conclusively prove the statement, the prognosis must be regarded as unfavorable. In my four cases one patient, as already remarked, died from suffocation; two recovered under treatment, and one ceased attendance after an unsuccessful attempt to destroy the growth. In Dr. Fifield's case the patient died suddenly from suffocation; in each of Störk's three cases tracheotomy was recommended, but only one of the patients consented to it. In this case, which was complicated by an external tumor involving the right pneumogastric nerve, recurrence took place, tracheotomy was performed a second time, and a cure ultimately resulted, an anti-syphilitic treatment being carried out simultaneously with the operative procedure. In Störk's other two cases the patients probably died, unless tracheotomy was performed, and the same observation applies to my second case.

Treatment.—If the symptoms are not urgent, and the tumor is small and situated high up in the trachea, an attempt should be made to destroy it by electric cautery; but if the growth is large, or is situated low down, tracheotomy should be performed without delay. An extensive vertical incision should be made in the windpipe, the cut edges held well back, and the growth most carefully removed with cutting forceps or curved scissors. The base of the neoplasm should then be most thoroughly cauterized.

SHORT ABSTRACTS OF ALL THE CASES OF TRACHEAL GROWTHS OBSERVED BY THE AUTHOR.

Case 1.—Henry L., aged forty-one, came under my care at the Hospital for Diseases of the Throat, March 2, 1865, suffering from hoarseness and slight dyspnœa. The larynx was congested, and the patient was treated with astringent solutions. On October 16th a growth, about the size of a bean, was seen occupying the second and third rings of the trachea anteriorly. In November several unsuccessful attempts were made to seize the growth with tube-forceps, but on December 21, 1865, in the presence of Dr. Pratt, now of Paris, I succeeded in touching it with an electric-cautery point. The day afterward a flat black eschar was all that remained of the growth, and a week later there were no signs of it.

Case 2.—Margaret C., aged twenty-two, applied at the Hospital for Diseases of the Throat in February, 1868, suffering from dyspnœa and weakness of voice. A growth about the size of a pea was seen on the third ring of the trachea, rather to the left side of the median line. An attempt was made to destroy it with electric cautery, but the patient moved, and both the vocal cords were slightly injured. The patient did not apply again.

Case 3.—Charles W., aged thirty-seven, a clerk, applied to me on March 6, 1874, suffering from hoarseness and dyspnœa. A growth was seen just above the anterior commissure. This was removed with the lateral cutting forceps in five sittings. After the last operation a growth of about the size of a white currant was seen occupying the first and second rings of the trachea. The cricoid cartilage could be distinctly seen above the growth. After two failures, on November 11th I succeeded in touching the polypus with an electric cautery-point, and a week later there was not a vestige of the neoplasm. Mr. Poyntz Wright examined the case repeatedly with the laryngoscope both before and after the treatment.

Case 4.—Thomas C., aged forty-five, came under my care at the Hos-

pital for Diseases of the Throat on June 15, 1876, suffering from dyspnœa. A smooth, bright red polypus, about the size of a grape, was seen covering the fourth, fifth, and sixth rings of the trachea anteriorly, and blocking up the greater part of the tracheal lumen. Tracheotomy was proposed but refused, and the patient returned home. I subsequently learnt that he died suddenly, three months later, it was said, from apoplexy ; but no post-mortem examination was made, and I feel convinced that the real cause of death was suffocation.

Osseous Growths.

In addition to the defined tumors already referred to, it is necessary to make a few remarks on the structural changes which the tracheal cartilages occasionally undergo. Rose [1] has called attention to the frequency of atrophy and fatty degeneration of the cartilages when pressed on by the enlarged thyroid gland, and after a certain age cretaceous changes may be looked upon as physiological products ; but true bone is sometimes found replacing the cartilaginous rings or occurring between them. Some years ago Dr. Wilks [2] brought before the Pathological Society a specimen taken from the body of a phthisical patient, in which, beneath the mucous membrane on the anterior wall of the trachea, there was an immense quantity of small bony lamellæ. These were situated between the rings of the trachea, and were not in direct connection with the cartilages. Microscopical examination showed a true bony structure. A similar deposit was found to a lesser extent beneath the mucous membrane of the bronchi. Dr. Chiari [3] showed a specimen of osteoma of the trachea at the Imperial Royal Medical Society of Vienna, May 24, 1878. The growth consisted of a lamella of bone, four centimetres long and three centimetres wide, and from three to four millimetres in thickness. Some minute bony deposits were also found in the larger bronchi. The patient died of acute tuberculosis. Lastly, Dr. Solis Cohen [4] discovered in the trachea of a phthisical patient after death a considerable number of minute closely aggregated enchondromata, beneath the mucous membrane covering the anterior portions of the tracheal rings.

Post-Tracheotomic Vegetations.

Most surgeons who have had the opportunity of watching recent cases of tracheotomy must have noticed the tendency to the formation of "proud flesh" on the edges of the wound. This redundant development is especially likely to take place in cases where the wound is allowed to remain bathed in secretions, or indeed in a very moist condition. On temporarily removing the tracheal canula, these vegetations are often sucked into the wound, and if the tube is not quickly replaced the dyspnœa sometimes becomes very urgent. By touching the parts with solid nitrate of silver, and keeping the wound dry, the vegetations, as a rule, soon disappear. Cases, however, have occasionally been reported in which similar growths

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[1] Der Kropftod, etc., Berlin, 1878.
[2] Trans., 1857, vol. vii.
[3] Lond. Med. Rec., July 15, 1878.
[4] Diseases of the Throat, etc., second ed., p. 511.

form on the tracheal mucous membrane *after the wound has cicatrized.* The first case of the kind was recorded by Dr. Gigon,[1] and subsequent examples have been reported by Krishaber,[2] Bouchut,[3] and others. Recently Dr. Petel[4] has collected and analyzed all the cases hitherto placed on record, amounting to ten in number, and including one observed by Dr. Petel himself. The following are his most important conclusions: The vegetations always grow from the mucous membrane covering the tracheal surface of the cicatrix; they are most frequently found in children of the male sex from fifteen days to a month after the wound has healed, and they never occur after two months have elapsed. As might be naturally expected, the occurrence of these vegetations is most to be feared in those cases in which the formation of "proud flesh" has been previously observed around the tracheal canula. The *symptoms* are those of embarrassed respiration, and may either partake of the character of progressive dyspnœa or sudden suffocation. The proper *treatment* consists in carefully dividing the cicatrix, removing the growth with cutting-forceps and cauterizing its base. Sometimes the polypus is difficult to find, and if a canula is inserted, it is likely to press it down and conceal it. It is necessary therefore to make a very careful examination, if the polypus does not at once present himself.

Pathologically, these vegetations, according to M. Ranvier,[5] "resemble those which develop around setons and drainage tubes," but he thinks it "possible that a papillary polypus, clothed with epithelium, may, under the influence of traumatic laryngitis, take on the character of proud flesh." Indeed, some of the observers who have reported examples of the affection are of opinion that these so-called "post-tracheotomic polypi" are in every case true tracheal polypi, which existed before the performance of the first operation, and led to it either directly or indirectly through the associated inflammation of the mucous membrane of the larynx and trachea. For, although in most of the cases the operation was nominally performed on account of "croup," it must not be forgotten that in former years laryngeal growths were constantly mistaken for that affection, and such an error of diagnosis would be still more likely to ensue where the trachea was the seat of the disease. The balance of evidence is, however, very strong in favor of the post-tracheotomic theory—the fact that the growth is always situated on the cicatrix being to my mind conclusive.

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[1] Union Médicale, May 10, 1862.
[2] Bull. de la Soc. de Chirurgie, 1874, p. 108.
[3] Gazette des Hôpitaux, 24 Mars, 1874.
[4] Des Polypes de la Trachée, Paris, 1879.
[5] Bull. de la Soc. de Chir., 1874, p. 108.

[MALIGNANT TUMORS OF THE TRACHEA.

Under this head are included (1) Carcinomata, (2) Sarcomata.]

CANCER OF THE TRACHEA.

Latin Eq.—Carcinoma tracheæ.
French Eq.—Cancer de la trachée.
German Eq.—Krebs der Trachea.
Italian Eq.—Cancro della trachea.

Definition.—Primary cancer of the trachea giving rise to dyspnœa, and, if not relieved by surgical treatment, to fatal apnœa.

This disease is so rare that it does not require to be treated with the same detail as most of the other tracheal diseases. The *origin* of cancer is probably always to be found in an abnormal formative property with which the tissues are primarily endowed, but it would appear that the perverted energy is, as a rule, only called forth by some local irritation. The remarkable relative immunity which the trachea enjoys may be explained by its freedom from functional excess and accidental injury. The principal *symptom* of the affection is tracheal stenosis, but an accurate *diagnosis* can only be made with the aid of the laryngoscope. As regards *pathology*, of the only two cases with which I am acquainted, one was described as a soft cancer, and the other was an example of epithelioma.

In the case reported by Langhans[1]—the only example hitherto published—the patient was a man aged forty, who suffered for one year from symptoms of stenosis of the bronchi—especially of the right bronchus—and died from suffocation. The post-mortem examination revealed carcinomatous degeneration of the mucous membrane of the trachea above the bifurcation, and of the bronchi just below that spot. The microscope showed that the neoplasm was a soft carcinoma, which took its origin in the glandulæ of the mucous membrane. There was no disease of any other organ. The *prognosis*, it need scarcely be said, is most unfavorable, the patient being unlikely to live more than a year or two at the most.

Treatment.—Soothing inhalations and sedative medicine may be administered, and when the growth is high in the trachea tracheotomy may be performed with advantage. Extirpation of the trachea with a view of eradicating the morbid growth will probably be attempted in future cases.

CASE OF CANCER OF THE TRACHEA.

Jane E., aged fifty-seven, an unmarried woman who "was formerly gay, and had had the bad disease," came under my care at the Hospital for Diseases of the Throat in April, 1864, suffering from shortness of breath, which had lasted for six months. *Diagnosis:* Tracheal stenosis, probably syphilitic, but no evidence of constitutional syphilis; congestion of larynx, but no narrowing. Dysphagia subsequently came on, and the

[1] Virchow's Archiv, liii. p. 470.

patient died in January, 1865. On post-mortem examination an ulcerated growth was discovered occupying the middle third of the trachea, and originating from three sides of the tube; the largest portion of the base of the growth, however, was on the posterior wall, which was thickened and projected backward into the œsophagus. The lining membrane of the œsophagus was perfectly smooth, and the vertical extent of the projection into its canal was only a centimetre. The trachea, on the other hand, was contracted at its narrowest part to such an extent that a probe four millimetres in diameter could only be passed with difficulty. The growth extended to within half an inch of the cricoid cartilage above. A portion of the morbid structure was examined by Dr. Andrew Clark, and pronounced to be "typical epithelial cancer," containing numerous nested-cells. The tissues around the trachea were slightly thickened, and two of the bronchial glands were somewhat enlarged.

Cancer from Contiguity.

Secondary cancer of the trachea, in the true sense of the word, is, I believe, unknown; but cancer due to contiguity, that is to say, to the extension of the disease from the neighboring parts, is by no means rare. It is from the œsophagus that the disease generally spreads, a large number of cases of malignant disease of the gullet ultimately involving the trachea. Sometimes there is merely an infiltration of the posterior wall, but not unfrequently the growth sprouts into the tracheal canal, and a fistulous communication is often established between the two tubes. Extension of malignant disease also sometimes takes place from the thyroid gland, and occasionally a mediastinal tumor penetrates the trachea. In the œsophageal cases the occurrence of dyspnœa, where previously dysphagia alone existed, at once points to the nature of the affection; but it is sometimes difficult to determine whether the symptoms are caused by compression from an external tumor, or its penetration into the windpipe. The fetid odor which is generally perceived when a cancer opens into the trachea usually at once proclaims the fact; in some cases, moreover, cancerous matter can be discovered with the microscope in the expectoration. In contiguous cancer it is seldom desirable to attempt to prolong life by the performance of tracheotomy.

Sarcoma of the Trachea.

Two cases of sarcoma have been reported by Professor Schroetter.[1] One was that of a man, aged thirty-four, who suffered from a smooth lobular pedunculated tumor, reaching up to a level with the fourth tracheal cartilage, and apparently covering two or three of the cartilages immediately below. After removing some portions of the growth with the tube-forceps, Schroetter injected the remainder with a strong solution of perchloride of iron, which resulted in wasting of the neoplasm so that only a small stump remained. Recurrence, however, soon took place, and portions have from time to time been since removed with forceps. When last heard of, tracheotomy was imminent. The second case

[1] Jahresbericht der Klinik für Laryngoscopie, 1871, p. 80 et seq., Laryngolog. Mittheilungen, 1875, p. 102.

referred to above passed out of Schroetter's hands, and came a few years later under the care of a young physician, who attempted to carry out the treatment by means of injection which had proved so successful in Schroetter's hands. Unfortunately, however, spasm of the glottis supervened, and the patient died before tracheotomy could be performed. Whilst admiring Professor Schroetter's skill, I cannot refrain from expressing my opinion that the treatment by injection of perchloride of iron is as hazardous as it is difficult; the preferable mode of treatment in such cases has been already laid down (see page 383).

SYPHILIS OF THE TRACHEA.

Latin Eq.—Syphilis tracheæ.
French Eq.—Syphilis de la trachée.
German Eq.—Syphilis der Trachea.
Italian Eq.—Sifilitide della trachea.

Definition—Syphilis attacking the trachea and giving rise to the various pathological changes which are met with in the secondary and tertiary stages of that disease when affecting mucous membranes.

Etiology.—The determination of disease to the trachea in syphilitic persons is probably due to some accidental congestion or old-standing relaxation of the mucous membrane of the part. According to my experience the affection is rare, only three cases, all of them tertiary, having been met with amongst 1,145 patients suffering from syphilis of the pharynx, larynx, and trachea (see page 257). Nevertheless, as attention has been directed to the subject for many years, the literature is pretty extensive (see page 390). Most of the cases I have met with have occurred between the ages of twenty-five and forty; whilst in twenty-two cases collected by Gerhardt [1] there was only one in the first decennium. Hüttenbrenner [2] has, however, recorded a case in a girl twelve years old, and Woronichin [3] has reported an example of syphilitic ulceration of the posterior wall of the trachea, close to the right bronchus, in a child fourteen months old. Examples of hereditary syphilis occurring in infants will no doubt be met with if sought for in the children's hospitals and workhouse infirmaries.

Symptoms.—The subjective symptoms being very slight, the early phenomena can only be discovered with the aid of the laryngoscope. At the inception there may be only obstinate congestion, but occasionally condylomata are met with. The latter condition is, however, very rare. I have myself observed it in only five cases, and Seidel [4] has reported one instance. Superficial ulcers are also occasionally seen. The characteristic tracheal condition, however, of syphilis is the narrowing of the tube which occurs in the later stages, and which will be fully described in the next article.

Diagnosis.—The diagnosis of the affection can generally be made out

[1] D. Archiv f. Klin. Med., Bd. ii.
[2] Jahrbuch für Kinderkrankheiten, 1872, vol. v.
[3] Ibid., 1875, vol. viii.
[4] Jen. Zeitschr. f. Med., Bd. iii.

by the history of the case, the use of the laryngoscope, and the exclusion of diseases likely to produce compression.

Prognosis.—Even in slight cases the occurrence of syphilis in the trachea must be looked upon as a very serious affection. Indeed, the mildest secondary phenomena indicate that the trachea is predisposed to the affection, and that the patient is not unlikely to suffer from those later manifestations which are amongst the most fatal consequences of the syphilitic poison.

Pathology.—It is only the pathological changes met with in tertiary syphilis which need be seriously considered. It is probable that most cases of important structural change in the trachea as the result of syphilis commence with gummatous deposits in the submucous tissue. These deposits soften and give rise to ulcers which, under suitable treatment, heal, and in process of cicatrization form a dense tissue which greatly narrows the canal. It is true, as Lancereaux [1] has pointed out, that these changes cannot always be discovered, but from the fact that the various stages are sometimes present in different parts of the trachea in the same case,[2] it is presumable that the sequence of morbid development is such as has been described. Great cicatricial narrowing of the tracheal canal is the most characteristic condition. In a case reported in the next article, the widest diameter of the constricted portion of the trachea was only one-eighth of an inch. There is often dilatation of the canal both above and below the seat of the stricture. The walls of the trachea are ultimately converted into a dense fibrous tissue, and this change generally affects their entire thickness, and extends over a very large superficial area of the canal. Small ulcers and projecting ridges are frequently seen, but occasionally the ulcers are of a very considerable size, and in some cases the disease involves portions of the cartilaginous rings which are either denuded and necrosed, or have been absorbed [3] or expectorated. Not only is the lumen of the trachea diminished, but the actual length of the tube is sometimes reduced, and one case [4] is on record in which a fistulous communication took place between it and the œsophagus. The seat of the disease is most frequently the lower part of the trachea.

Treatment.—The early manifestations, as a rule, soon disappear, but the tertiary phenomena generally resist treatment altogether, or are only temporarily relieved. As the patient is generally much broken down in health, iodide of potassium in small doses should be tried at the outset, and if the remedy agrees, the dose should be quickly increased, ten, twenty, or even thirty grains being given three times a day. If this treatment does not afford relief after a week or two, the patient should be rapidly brought under the influence of mercury. In these cases it is no use giving the per-salts in small doses for a long time, but either inunction, subcutaneous injection, or some quickly acting form of mercury should be employed. In one case in which three grains of gray powder were given with two grains of henbane three times a day, slight ptyalism was produced after twenty grains had been taken, and two days later the dyspnœa completely passed off. In another case excellent results were produced by the same remedy after it had been administered for five days. In both these cases, however, relapse took place after a few weeks. If the therapeutical measures already detailed do not give relief, trache-

[1] Treatise on Syphilis, New Syd. Soc. Trans., 1869, vol. ii.

[2] Moissenet: Union Médicale, 1864, nouv. série, f. xxi. p. 340.

[3] An excellent illustration of this absorption has been recorded by Worthington: Med.-Chir. Trans., 1842, vol. xxv.

[4] Beger: Deutsches Archiv für Klin. Med., May 15, 1879.

otomy must be performed when there is a possibility of getting below the seat of obstruction. The circumstances which govern the performance of the operation will be referred to in the next article.

STRICTURE OF THE TRACHEA.

Latin Eq.—Strictura tracheæ.
French Eq.—Rétrécissement de la trachée.
German Eq.—Verengerung der Trachea.
Italian Eq.—Ristringimento della trachea.

Definition.—Narrowing of the tracheal canal from thickening of the walls of the tube.

History.—Stenosis of the trachea was referred to by Heister,[1] Albers,[2] and others, but the subject was first treated in a thoroughly systematic manner by Demme.[3] Since that time a large number of isolated cases have been published, and the subject has been handled in a most philosophical way by Gerhardt,[4] whilst a complete bibliography and very comprehensive article have been published by Riegel.[5]

Etiology.—Tertiary syphilis is almost invariably the cause of tracheal stricture, but it is occasionally produced by other diseases, such as cancer, benign growths, and chronic tracheitis. There are only two cases of primary cancer on record (pp. 386, 387), but not infrequently a malignant growth penetrates from the œsophagus to the trachea. In these cases, however, death generally takes place so rapidly from perforation of the posterior wall of the trachea, that the subject need not be considered here. On the other hand, benign growths of a defined character are so extremely rare that nothing need be here added to what has been stated of them under their proper heading.

Symptoms.—Patients affected with tracheal stricture are generally feeble, anæmic, and emaciated, and on careful examination usually show some evidences of constitutional syphilis. The most marked symptom of the affection is dyspnœa. This symptom varies in intensity according to the degree in which the tracheal canal is narrowed, and is, as a rule, greater during inspiration than expiration. It is, however, subject to considerable variation according to the extent and situation of the stricture. When the disease is only in its earliest stage, valuable information may sometimes be obtained by employing Waldenburg's[6] system of pneumatometry or Riegel's[7] graphic method of investigation. Tracheal dyspnœa, as Gerhardt[8] first pointed out, is characterized by an absence of movement on the part of the larynx, whilst in laryngeal obstruction the larynx falls and rises with great energy in each act of respiration. There is often considerable stridor, but the sound has never the metallic ring of laryngeal

[1] Med. Chirurgische Wahrnehmungen, No. 297, p. 843.
[2] Atlas der Pathol. Anat., ii. p. 135.
[3] Ueber Stenose der Trachea, Würzburg Med. Zeitschrift, Bd. ii.
[4] Ueber Syph. Erkrank., Deutsches Archiv f. Klin. Med., Bd. ii. p. 535.
[5] Ziemssen's Cyclopædia, vol. iv. p. 470.
[6] Die pneumatische Behandlung, Berlin, 1875.
[7] Athembewegungen, Würzburg, 1873.
[8] Lehrbuch der Auscultation, etc., Tübingen, 1871.

obstruction. Gerhardt has also observed that in severe tracheal dyspnœa the head, instead of being thrown back, as it is in cases of laryngeal obstruction, is either kept in the ordinary position or bent forward. The stethoscope yields only negative signs, the vesicular murmur being overpowered by the tracheal noise, which is generally more audible over the larynx than over the seat of stricture. In cases of long-standing stricture, the circumference of the thorax is stated by Demme[1] to be contracted, especially in the upper part. The voice is feeble but clear. With the laryngoscope the contraction can often be seen. It frequently has the appearance of a number of concentric rings diminishing in size from above downward (see Fig. 111), and terminating in a small round or oval opening. It is exceedingly difficult to determine the exact level of the stricture, the usual landmarks which in health furnish the perspective below the vocal cords being wanting. If not relieved by medical treatment or a surgical operation, these cases almost invariably terminate fatally. As a rule, death takes place from coma following on pneumonia or œdema of the lungs, but sometimes the patient dies from apnœa due to a sudden attack of spasm of the trachea.

Pathology.—The pathology of this affection must be sought for under the various diseases which give rise to stenosis, such as syphilis, cancer, benign growths of trachea, and tracheitis. It must be borne in mind, however, that the malady which gives rise to stricture is almost always syphilitic. The stricture is generally situated at the lower part of the trachea, but occasionally it occurs quite at the commencement of the tube ; the middle third is most rarely attacked. Sometimes, however, the whole length of the trachea is diseased, and its lumen throughout greatly diminished.

Diagnosis.—When once an example of tracheal stenosis has been met with, there will, as a rule, be no difficulty in recognizing subsequent cases, and I have known a hospital nurse, after her first experience, at once diagnose the affection. It is the character of the breathing and a peculiar noise made in inspiration which distinguish the condition. It is extremely difficult, however, to differentiate a *stricture* from *compression* of the trachea. Tracheoscopy may settle the question, and in some cases the existence of disease of the thyroid body or cervical glands, a mediastinal tumor, or an aneurism of the aorta, may point to an external cause of pressure. Again the same condition which gives rise to compression of the trachea, may also cause pressure on one of the recurrent nerves, and thus lead to paralysis of one of the vocal cords. This is a point worthy of consideration when the evidence of compression is very slight. The difference between laryngeal and tracheal dyspnœa has been referred to under " symptoms ; " *bronchial* stenosis, when due to plugging of only one of the primary bronchi, may be recognized by the absence of breath-sounds in the corresponding lung, which, at the same time, retains its resonance on percussion. When, however, both bronchi are pressed upon, it is almost impossible to distinguish the affection from tracheal stenosis. The impaction of a foreign body in the trachea may give rise to difficulty in diagnosis, but from the history of the case and the sudden supervention of the symptoms there is generally little difficulty on that score. A case, however, has been recorded by Stokes[2] in which a stricture was suspected until tracheotomy was performed, when a pultaceous fetid mass of decomposing cheese was expelled, to the instant relief of all the symptoms.

[1] Op. cit.

[2] Diseases of the Lungs and Windpipe, Dublin, 1837.

Treatment.—If the symptoms are not very urgent, the therapeutical measures described in the last article should be attempted ; but it must be remembered that stricture of the trachea is, as a rule, of a cicatricial character, and that therapeutic efforts are likely to prove in vain. Soothing inhalations, however, such as hop and benzoin, sometimes relieve spasm and diminish irritation. If the symptoms are very urgent and the stricture is situated in the upper or middle third of the windpipe, tracheotomy should be performed, but if the stenosis is lower down, the operation is of no avail and should on no account be carried out. Unfortunately, it cannot always be determined how low a stricture extends ; for though its upper limit may be seen with the laryngoscope to be close to the larynx, the cicatricial tissue may pervade the whole length of the trachea, and, as in the following case, an operation which promises success may prove perfectly futile:

Robert Collins, aged thirty-one, an engraver, was admitted into the Hospital for Diseases of the Throat on account of great dyspnœa, January 7, 1870. An examination with the laryngoscope was made with great difficulty, owing to the patient being very nervous, but ultimately the larynx was found to be perfectly healthy. On inspecting the trachea, however, the canal was seen to be narrowed by a kind of web, which was attached round the edges of the trachea, leaving only a narrow opening, the widest diameter of which seemed less than six millimetres. The exact situation of the web, that is to say, its distance below the vocal cords, could not be ascertained, as the patient could only bear a very rapid examination. His friends stated that he had been short of breath for two years, and that on several occasions recently he had fallen down insensible. On his way to the hospital he had walked very slowly, and had been compelled to stop two or three times for want of breath. Tracheotomy was performed with some difficulty, owing to considerable fibrous enlargement of the thyroid gland especially affecting its isthmus. The patient was very little relieved by the operation and died sixteen hours after it. On post-mortem examination a stricture of the trachea was found, which commenced an inch and three-quarters below the vocal cords, and extended downward for rather more than an inch ; at its narrowest part the diameter of the canal measured only three millimetres. The lower edge of the stricture was formed by a white cicatricial ridge, and from it there radiated downward several similar eminences. There was also a large flat depressed scar below the stricture.

FIG. 111.—Concentric Stricture of the Trachea.

Compression of the Trachea.

The most common *cause* of this condition is enlargement of the thyroid gland, but it is not unfrequently occasioned by aneurism of the aorta. More rarely disease of the cervical glands,[1] or general lymphoma of the

[1] An interesting case has been recorded by Rush : Medical Observations and Enquiries of a Society of Physicians, vol. v. p. 96, in which a tumor (probably an enlarged gland) about the size of an English walnut, containing an offensive material, caused compression of the trachea. See also the cases referred to in note 1, p. 412.

neck, gives rise to it, and still less frequently it is caused by mediastinal tumors. The *symptoms* are precisely the same as those referred to under the head of "stricture," and the *diagnosis* between the two affections can often only be arrived at by careful tracheoscopic examination. There is little to be said on the subject of the *pathology* of compression, but it may be remarked that the pressure often actually gives rise to disease of the structures constituting the walls of the trachea. In advanced cases there is hypertrophy of the glandulæ and of the areolar tissue. The mucous membrane is thrown into irregular ridges, and the cartilaginous structures are diminished in volume, and in some places completely absorbed. The *prognosis* varies according to the exact site of the narrowing, being, of course, less favorable when the pressure is on the lower part of the trachea. The only *treatment* of any avail consists in the removal of the tumor causing compression, or, if this cannot be accomplished, in the performance of tracheotomy, and the employment of König's long flexible canula (page 376).

TRACHEAL PHTHISIS.

Latin Eq.—Phthisis trachealis.
French Eq.—Phthisie trachéale.
German Eq.—Trachealschwindsucht.
Italian Eq.—Tisi della trachea.

Definition.—A chronic affection of the trachea characterized by tumefaction and ulceration of the softer structures, and sometimes by exposure and destruction of the cartilages, arising from a local deposit of tubercle, which is probably always preceded by a similar disease of the lungs.

Etiology.—The previous existence of pulmonary phthisis must be regarded as the exciting cause of the tracheal affection, but the manner in which it operates is unknown. Hitherto the affection has received but little attention, though a few cases have been reported by Louis,[1] Wilks,[2] and others. The comparative unimportance of the affection is probably the reason why it has attracted so little attention, for it is by no means uncommon. Thus, out of 1,236 cases of pulmonary phthisis occurring at the Pathological Institute of the University of Leipzig[3] there were 99 cases of ulceration of the trachea, in 80 of which the larynx was at the same time affected. In 100 autopsies of laryngeal phthisis I found 27 examples of ulceration of the trachea, which gives a rather larger proportion. Of these 27, 17 were males and 10 females. In 13 cases of tracheal phthisis (uncomplicated by a laryngeal affection), 9 were males and 4 females. All the cases occurred between the ages of 24 and 47. With regard to the general etiology of the subject, the reader is referred to the causes of laryngeal phthisis (page 267).

Symptoms.—The phenomena due to the tracheal affection are gener-

[1] Researches on Phthisis, Syd. Soc. Trans., by Dr. Walshe, 1844, pp. 263, 268.
[2] Guy's Hospital Reports, vol. xv. p. 8.
[3] Heinze: Op. cit.

ally masked by the more objective symptoms of the coexistent pulmonary and laryngeal diseases, and it is only occasionally that the tracheal affection is noticed during life. Anæmia of the mucous membrane, which has been observed as a precursor of laryngeal phthisis (see page 270), may sometimes be noticed in the trachea. As the disease progresses ulcers can be seen on the anterior wall of the tube. In the early stages there is nothing, except their intractability, to distinguish these ulcers from those which are due to catarrh, but in severe cases the denudation of the cartilages and their necrotic appearance is characteristic. In two cases (uncomplicated by laryngeal phthisis) which have come under my notice, inspiratory dyspnœa was a marked symptom. There is, generally, a considerable amount of expectoration and cough ; but in the presence of the pulmonary affection, it is not possible to tell how far these symptoms depend on the condition of the trachea.

Pathology.—The histological changes which take place in tracheal phthisis are, probably, similar to those which have been described in connection with the laryngeal affection (see page 274). The ulcers vary in size and depth, being generally of round or oval shape, and measuring from a millimetre to a centimetre in diameter, the most common size being from two to four millimetres. They are far more common on the posterior wall than at any other part, and more numerous at the lower than the upper portion of the trachea.

Diagnosis.—The existence of the disease can only be arrived at during life with approximate certainty, by discovering evidences of pulmonary phthisis ; but even under these circumstances, it must not be forgotten that catarrhal ulceration of the trachea may coexist with true pulmonary phthisis. The possibility of the simultaneous occurrence of a syphilitic stricture of the trachea and a deposit of tubercles in the lungs must also be borne in mind.

Prognosis.—Except in those cases where the disease leads to destruction of the cartilages, it, probably, but little affects the issue of the complaint. Of course, however, where the cartilages are exposed and project into the trachea, some stenosis may result, and the fatal termination be hastened.

Treatment.—Soothing inhalations and sedative insufflations are sometimes required, but, as a rule, the disease calls for little interference. In those rare cases, however, in which the affection causes narrowing of the upper part of the tracheal canal, tracheotomy may prolong a miserable existence for a few weeks or months.

WOUNDS OF THE TRACHEA.

Latin Eq.—Vulnera tracheæ.
French Eq.—Plaies de la trachée.
German Eq.—Wunden der Trachea.
Italian Eq.—Ferite della trachea.

Definition.—Wounds of the trachea of an incised, punctured, or contused character, with or without wound of the integument, generally giving rise to subcutaneous emphysema and considerable dyspnœa.

Etiology.—Incised wounds are generally of a suicidal origin, whilst those of a punctured character may be inflicted by sword [1] or bayonet, or indeed by any sharp instrument.[2] Contused wounds are rare, and are usually complicated by great injury of the larynx ; the cartilages of the windpipe are often crushed, and the accident is generally described as *fracture of the tracheal cartilages.* Gurlt [3] has collected nine examples, in four of which the trachea alone was damaged. When the tracheal rings are torn apart, or the trachea is detached from the cricoid cartilage, the accident is usually reported as *rupture of the trachea.* It will be easily understood that these severe injuries may occur in many different ways. Sometimes they result from the kicks [4] of horses or men. Atlee [5] has reported a case in which a boy fell on a curb-stone, striking his neck against a scraper; and Drummond [6] has related an instance in which an aged woman fell forward and struck her neck against one of the upright spindles of the back of a chair from which the top transverse rail was missing. In the case of a man recently sent to me by Mr. Stretton, of Kidderminster, the left side of the trachea opposite the fourth and fifth rings was forced slightly inward, and the inferior cornu of the thyroid cartilage dislocated forward by a trivial accidental blow with the side of the unclosed hand. In a case [7] recorded by Long the patient was caught between two railway buffers. Professor Gross [8] has reported a case in which rupture of the trachea resulted from violent inspiratory efforts to relieve the dyspnœa caused by the pressure of a large thoracic aneurism, and Gurlt [9] mentions another in which a similar accident occurred to an infant under two years of age who kept tossing his head violently about during an attack of bronchitis.

Symptoms.—The symptoms vary according to the nature and intensity of the injury. Dyspnœa is the most common phenomenon, but there is frequently spitting of blood, and extensive emphysema of the areolar tissue is also very often present. Ambrose Paré described a case in which "the wind went forth from the wound over the whole body, so that the patient could not articulate in the least." There is often abrasion of the surface of the neck, and not unfrequently the larynx is injured. Occasionally the trachea is torn through transversely. These cases generally terminate fatally, but Long's patient recovered.[10]

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[1] Ambroise Paré : Œuvres Complètes, par Malgaigne, 4 liv. 8, chap. xxx.

[2] Atlee : Amer. Journ. Med. Sci., 1878, p. 433; a case in which a boy punctured his trachea with the point of closed scissors ; emphysema ensued, but the child recovered.

[3] Handbuch der Knochenbrüche, p. 316 et seq. In injecting bronchocele, I have, on three occasions, penetrated the trachea. This accident is, however, excessively rare, as I must have injected bronchoceles at least 5,000 times. On two occasions no inconvenience resulted, the patient merely expectorating a little iodine, but in a third case, in which an exploratory trochar was used on a boy twelve years of age, persistent hæmoptysis instantly arose. An attempt was made to arrest the hemorrhage by the inhalation of a tannic acid spray, but it produced no effect. About a quarter of an hour from the time of the accident I injected a few drops of perchloride of iron through the small opening in the thyroid gland, and the bleeding was immediately arrested. It is worthy of remark that no hemorrhage took place externally.

[4] O'Brien : Edin. Med. and Surg. Journ., vol. xviii. Robertson : Lancet, September 6, 1856. Hunt : Amer. Journ. Med. Sci., April, 1866, p. 378.

[5] Amer. Jour. Med. Sci., January, 1858.

[6] Brit. Med. Journ., December 28, 1872.

[7] Med. Times, May 10, 1856.

[8] Pathological Anatomy, third edition, 1857. p. 404.

[9] Op. cit.

[10] Op. cit.

Diagnosis.—An accident being known to have occurred, there can be little difficulty in arriving at the diagnosis. Accurate information will, no doubt, in future cases, be sometimes obtained with the aid of the laryngoscope, but, as a rule, the external contusion and other symptoms render the diagnosis very easy.

Prognosis.—The prospect of the patient depends on the nature of the injury and on the complications which may be present. Extensive contusions add greatly to the risk of a wound in the trachea. On the other hand, punctured and incised wounds often do well.

Pathology.—The pathology of the disease depends on the amount and kind of injury which has been inflicted.

Treatment.—In injuries accompanied with much contusion tracheotomy is almost always necessary. Even if not urgently called for, it can add little to the risk of the patient, and may be the means of warding off the danger of a sudden access of spasm. In very slight wounds, where it is thought tracheotomy may be omitted without risk, the patient should be kept in bed in a state of *absolute quietude*, especially in the case of children, for it must not be forgotten that the least struggle, such as might occur in giving medicine, may convert a slight wound into an extensive rupture, and thus bring about fatal results.[1]

Suicidal wounds of the trachea will be considered in the article on "Cut Throat"—(Vol. II.).

Bronchotomy, including Tracheotomy and (Crico-thyroid) Laryngotomy.

The older physicians used the word "Bronchotomy" as a general term for the various operations by which the air-passages are laid open, and under this head may be included thyrotomy (*i. e.*, laryngotomy, by median section of the thyroid cartilage), laryngotomy, as the term is understood in this country (*i. e.*, an opening through the crico-thyroid membrane), tracheotomy, in which the trachea is opened, and laryngo-tracheotomy, in which both larynx and trachea are cut into—an operation seldom performed. The subject of thyrotomy has been considered in discussing the treatment of laryngeal growths (page 236) and the other operations will be presently described. In dealing with the history of laryngo-tracheal operations, it would be inadvisable to separate them, whilst the preparatory stages and subsequent precautions are nearly the same in all cases. Hence it is convenient to consider under the ancient term of "Bronchotomy," the history of the operation, the indications for its performance, the use of anæsthetics, the various accessory appliances required in connection with the operation, the duties of assistants, the position of the patient and that of the operator, and the after-treatment.

History.[2]—Tracheotomy dates from about 100 B.C., and Galen[3] states

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[1] See Atlee's first case.

[2] In dealing with this subject, I have made considerable use of Sprengel's Geschichte der Chirurgie, Halle, 1805, but I have traced a large number of Sprengel's references to their original sources, and I find that many of them do not correspond with those given by that author. I have also omitted some of Sprengel's authorities on account of their comparative unimportance, and added the names of several which had escaped his notice.

[3] Opera Omnia quæ extant. De Bronchotomia. Venetiis, 1562.

that Asclepiades, of Bithynia, was the first to perform it. Aretæus,[1] in the first century, condemned the operation on the ground that wounds of cartilages cannot heal; and Cœlius Aurelianus,[2] nearly three hundred years later, agreed with Aretæus. Paulus Æginetа,[3] who lived in the seventh century, seems to have repeatedly opened the windpipe, and he also states that Antyllus, of Rome (A.D. 340), made a transverse incision into the trachea between its third and fourth rings, and drew the cartilages apart with hooks; as soon as the patient breathed more freely, he sewed the edges of the wound together again. The Arabians were never great as surgeons, and we find that tracheotomy was referred to by Abu 'l Kasem [4] and Ebn Zohr [5] only as a possibility. Science, like literature and art, was soon overwhelmed by the barbarism of the dark ages, and it was not until the revival of learning in the fourteenth century that we again hear of the operation of tracheotomy. At that time Guido de Cauliaco [6] attempted to introduce it. In the first half of the sixteenth century, a Florentine physician, Benivieni,[7] performed it successfully, and it was undertaken about this time both by Gulielmo de Saliceto [8] in a case of angina, and by Rolandi,[9] a Bolognese professor, to relieve stenosis produced by a laryngeal abscess. In 1546 Musa Brassarolo,[10] of Ferrara, performed the operation successfully, and fifty years later Sanatorius [11] for the first time used a trochar, and left a canula three days in the wound. Ambroise Paré [12] opened the trachea by means of a transverse incision in a case of angina, but he was opposed to a division of the rings of the trachea themselves. An important improvement was made somewhat later in this century by Fabricius ab Aquapendente,[13] who operated successfully in cases where foreign bodies were impacted in the larynx, and "when that tube was clogged with viscid mucus." He made a vertical incision through the tissues, and in order to avoid the danger of the tube falling down the windpipe, introduced a canula with wings. His pupil, Casserius,[14] made a very important improvement in introducing a canula with a curve corresponding to the arc of a quadrant, and he also tied the canula in position with tapes. The improvement in the shape of the instrument, however, was soon lost sight of, and the straight tube long remained in use. In the early part of the seventeenth century Habicot,[15] of Paris, performed tracheotomy with considerable success in inflammation of the larynx, and in Naples, Severinus [16] opened the trachea in a severe case of mumps; shortly afterward Renatus Moreau [17] performed the operation under similar cir-

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[1] De Cur. Acut. Morb., i. i. c. 7.
[2] De Morb. Acut., liii. c. 4.
[3] De re Medicâ Opus; Operationes, Paris, 1532.
[4] Chirurg., lib. ii. f. 43, p. 227.
[5] Theisir, lib. i. c. 14, f. 15d.
[6] Mingetonsault: La Grande Chirurgie, Paris, 1683.
[7] De Abditis Morborum ac Sanationum causis, cum Galeni, etc., Basil, 1528.
[8] Linhart: Compend. der chir. Operationlehre, 1877.
[9] Ibid.
[10] Comment. in Hipp. de Vict. Acut., iv. p. 120, Lugd. 1543, 12.
[11] Malavicini: Util. Collect. Med. Phys., Venet., 1682.
[12] Opera Chirurgica, Uffenbach's Thes. der Chirurg., Francof., 1610.
[13] Opera Chirurgica, Francof., 1620.
[14] De Vocis et Auditus Organo, Ferrara, 1600.
[15] Sur la bronchotomie, vulgairement dicte laryngotomie, ou perforation de flûte au tuyau du poulmon, Paris, 1620.
[16] De efficaci Medicina Chirurg. efficacis. pars ii. cap. xl. p. 93.
[17] Epist. de Laryngotomia, 1646. This memoir is cited by Heister, op. cit.

cumstances. Various suggestions were made by Scultetus,[1] Verduc,[2] Dionis,[3] and Garengeot,[4] whilst Dekkerus,[5] of Leyden, was the first to recommend a cutting trochar. In the middle of the eighteenth century Dethartig[6] employed the operation of bronchotomy in cases of drowning. An important advance was made in the second half of the eighteenth century, when George Martin[7] introduced the double canula. This valuable suggestion was, however, soon forgotten. The advocacy of tracheotomy by Louis,[8] especially in the case of foreign bodies in the air-passages, was most judicious, but many practitioners opposed the operation as very dangerous. The learned Van Swieten,[9] who was amongst the opponents of the operation, nevertheless recognized the value of Martin's inner tube. Soon after, we find the operation mentioned by Le Dran,[10] Platner,[11] and Sharp.[12] The last named surgeon, however, looked upon it as useless and dangerous in inflammation of the air-passages, and only advisable in cases where a bronchocele pressed on the windpipe. Bauchot,[13] apparently unacquainted with Dekkerus' instrument, introduced a similar tracheotome, and Heister[14] described the operation accurately, and employed a straight tube and trochar; he gave illustrations both of his own instrument and of that of Dekkerus, and was the first surgeon who used the term "tracheotomy." Richter[15] recommended the operation in the case of large nasal and pharyngeal polypi, in severe inflammation of the tongue, and in cases where the tonsils were greatly swollen. Desault[16] insisted on the value of laryngotomy in cases where foreign bodies were impacted in the larynx, but Home[17] was the first to recommend tracheotomy in croup; he was soon supported by Crawford,[18] Chaussier,[19] Schwilgue,[20] and others. Shortly afterward Vicq d'Azyr[21] wrote a memoir advocating crico-thyroid laryngotomy, and was strongly seconded by Fourcroy.[22] In the year 1782, John Andrews,[23] a London surgeon, performed tracheotomy successfully. In the year 1825 Bretonneau,[24] who had previously operated with fatal results, opened the windpipe of a child suffering from diphtheria. The case recovered, and in 1833 Trousseau[25]

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[1] Armamentarium Chirurgicum. Amstelodami, 1672, p. 127.
[2] Opérat. de Chirurg., Paris, 1703, p. 221.
[3] Ibid., 1708, p. 329.
[4] Ibid., 1720, vol. i. p. 491.
[5] Exercitat. Pract., Lug. d. Bat., 1694, p. 241.
[6] Haller: Diss. Chirurg., vol. ii. pp. 438–439.
[7] Philosoph. Trans., vol. vi.
[8] Mémoire sur la Bronchotomie, Mém. de l'Academ. Roy. de Chir., 1760.
[9] Commentar. in Hermann Boerhavii Aphorism., Aph. 813, etc., 1741–42.
[10] Opérat. de Chirurg., Paris, 1742, p. 219.
[11] Institut. Chirurg. Rationalis, Lipsiæ, 1758, p. 327.
[12] A Treatise of the Operations of Surgery, 4th edit., London, 1761, p. 187.
[13] Mémoires de l'Acad. de Chir., vol. iv. p. 506.
[14] A General System of Surgery, part ii. chap. cii., London, 1743.
[15] Max Schüller: Deutsche Chirurgie, Lief. 37, p. 4.
[16] Œuvres Chirurg., Paris, 1812, vol. ii. p. 236.
[17] An Enquiry into the Nature, Causes, and Cure of Croup, Edin., 1765.
[18] Dissert. de Cynanche Stridula, Edinbourg, 1771.
[19] Nauche: Pyrétologie de Selle, Paris, 1800.
[20] Recueil d'Observ. et des Faits relat. au Croup, Paris, 1808.
[21] Soc. Roy. de Méd., T. i. 1776.
[22] De Nova Laryngotomiæ Methodo, Th. Paris, 1779.
[23] Borsieri's Institutes. The information is contained in a letter addressed by Andrews to Borsieri.
[24] Des Inflam. Spéciales du tissu Muqueux, Paris, 1826.
[25] Clinique Médicale.

had a similar success. The unbounded enthusiasm of the latter operator, his immense industry and careful attention to details, not only before but during and after the operation, soon established the position of tracheotomy in modern surgery. It was not, however, till twenty-five years later that Roget[1] joined the tube to its shield by means of a collar permitting movement between the two parts. Amongst those who in recent times have sought to modify the instruments, to improve the method of procedure, to determine the relative merits of the various operations on the air-passages, or to lay down more clearly the indications for the performance of these operations, may be particularly mentioned Millard,[2] Chassaignac,[3] Malgaigne,[4] Kühn,[5] Thompson,[6] Pitha,[7] Ulrich,[8] Hueter,[9] Bardeleben,[10] Fuller,[11] Marsh,[12] and Planchon.[13] In 1868 Durham[14] introduced the right-angled canula, and since then Llewelyn Thomas,[15] Solis Cohen,[16] Thornton,[17] Baker,[18] Sanné,[19] and Krishaber[20] have contributed their experience. The most complete book, however, which has been published in recent years is that of Dr. Max Schüller,[21] which has just appeared.

In reviewing the history of tracheotomy, the following matters are specially worthy of attention: (1) The idea of opening the trachea in very remote times and its general acceptance in the Renaissance period; (2) the use of a canula—a straight one—by Sanatorius; (3) the addition of wings acting as a shield to prevent the canula dropping down the trachea by Fabricius ab Aquapendente; (4) the introduction of a curved tube instead of a straight one by Casserius; (5) the invention of the double canula by Martin; (6) the articulation of the tube to its shield, permitting of movement between the parts, by Roget; and (7) the use of angular tubes (the angles of which are of course eased off) by Durham.

Indications for Opening the Air-Passages.—Tracheotomy and its kindred operations may be performed under a great variety of conditions, but the relief of immediate or prospective dyspnœa is always the direct aim of the operation.[22] As this subject is treated with considerable detail in the various text-books of surgery, and is entered into at some length

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[1] Archives Générales de Méd., 1859.
[2] Thèse de Paris. Paris, 1858.
[3] Leçons sur la Trachéotomie, Paris, 1869.
[4] Médecine Opératoire, Ed. 7me, Paris, 1861, pp. 525, 528.
[5] Die künstliche Eröffnung der Obersten Luftwege, 1864.
[6] Lancet, 1853, vol. i. p. 221.
[7] Beitr. zur Würdigung der Bronchotomie, Prag. Vierteljahreschrift, 1857, Bd. i.
[8] Compendium der chir Operationslehre, Wien, 1862, p. 652.
[9] Pitha u. Billroth's Handbuch, vol. iii.
[10] Lehrb. d. Chirurg., Berlin, 1876, vol. iii. pp. 496, 505.
[11] Trans. of Med.-Chir. Soc., 1857, vol. xl. p. 69 et seq.
[12] St. Barth. Hosp. Reports, 1867, vol. iii. p. 331.
[13] Faits Cliniques de Laryngotomie, Paris, 1869.
[14] Holmes' System of Surgery, vol. ii. p. 497 et seq.
[15] Lancet, Sept. 28, 1872.
[16] Croup in its relation to Tracheotomy, Philadelphia, 1874.
[17] Tracheotomy, London, 1876.
[18] Lancet, Dec. 2, 1876.
[19] Traité de la Diphthérie, Paris, 1877.
[20] Annales des Maladies de l'Oreille, etc., 1876–78.
[21] Billroth und Luecke: Deutsche Chirurgie; Die Tracheotomie, Laryngotomie und Extirpation des Kehlkopfes, Stuttgart, 1880.
[22] In the case of the extraction of a foreign body, its removal is no doubt the immediate object of the operation, but still it falls within the category described in the text. The proper method of procedure in these cases will be described in the article devoted to the subject.

in many articles in this work, it can only be referred to here in a general way.

The question which always arises in the mind of the young surgeon is whether the symptoms are sufficiently urgent to render the operation necessary. On this point I think it desirable to remark that the indication for the operation is to be looked for in the condition of the thorax. It is the recession of the lower part of the sternum and contiguous ribs, and the retraction of the intercostal spaces and clavicular fossæ at each act of inspiration which call for tracheotomy, and the operator must not wait until lividity of the lips and blueness of the finger nails prove that the blood is being imperfectly oxygenated. It is, of course, especially in acute diseases of the larynx that tracheotomy yields the most satisfactory results, but in tracheal affections the operation often assists in bringing about a cure. When the disease of the trachea, however, is low down, as in some cases of tracheal stricture and tracheal compression, the operation is useless. It is true that great skill is required in detecting the exact site of these affections (see page 389), but it is better in a doubtful case to operate than to let the patient die without making any effort to relieve him. In cases of aneurism of the aorta, the operation must, as a rule, be avoided, but where that disease is associated with spasm of the glottis, or with complete paralysis of one of the abductors, tracheotomy may be required (see Case 2, page 316). It would seem scarcely necessary to call the attention of even the most inexperienced to the subject of asthma, but in two cases I have been requested by practitioners to perform tracheotomy in that complaint, bronchial asthma having been mistaken for spasm of the glottis. In reality, however, the diagnosis of asthma from laryngeal and tracheal obstruction is very simple. In the latter affections the dyspnœa is always inspiratory, whilst in asthma it is mainly expiratory, and is never accompanied with that retraction of the chest-walls which is noticed when the upper air-passages are affected. Further, in bronchial asthma the characteristic sounds are moist sibilant râles, heard most distinctly in expiration. It is sometimes difficult to distinguish laryngeal dyspnœa from the dyspnœa of tracheal obstruction. The diagnostic criteria of the former are an up-and-down-movement of the part of the larynx, considerable stridor, and generally an alteration in the voice; whilst tracheal obstruction is characterized by a peculiar hissing noise (see "Tracheal Stricture"), caused by the air passing through the narrowed canal, and an absence of movement on the part of the larynx.

The Use of Anæsthetics.—Notwithstanding the conclusion arrived at by the Committee of the Medico-Chirurgical Society,[1] I consider that the administration of chloroform increases the risk of the operation, for if any blood passes down the trachea, the chance of suffocation is much greater when the patient is unconscious. I have myself seen two cases in which this accident occurred under chloroform with a fatal result, whilst, on the other hand, I have several times seen life saved by the active efforts of the patient in expectorating blood. General anæsthesia should therefore, if possible, be avoided, and indeed in adults it is very seldom required. It may, however, be necessary to induce it in the case of children, in order to prevent their violent struggles, when the operator is alone or has an insufficient number of assistants. Owing to the irritating effect of ether on the laryngeal mucous membrane, chloroform should be employed if it is necessary to administer a general anæsthetic;

[1] Trans. Med.-Chir. Soc., 1864, vol. xlvii. p. 323 et seq.

local anæsthesia, *i. e.*, freezing effected with the ether spray is, however, as a rule, all that is really requisite.

Accessory Appliances.—The following accessories should be at hand, viz., a freezing apparatus for the application of the ether spray; small sponges for absorbing the blood; tapes for tying in the canula; a bolster about the size of a rolling pin tightly packed with bran for placing under the patient's neck, a faradic battery for stimulating the respiratory muscles in case the respiration should become feeble after the trachea has been opened, and bellows for effecting artificial respiration. The best instrument of the kind is that of Dr. Richardson.[1]

Duties of Assistants.—It is sometimes necessary to perform the operation very suddenly, and the practitioner may even find himself compelled to open the windpipe when he is quite alone with the patient; but if it is possible to arrange for the operation beforehand it is desirable to have three assistants, viz., one to freeze the neck in the first instance, and afterward to sponge the wound; another to maintain the head perfectly steady and the axis of the neck straight—a condition which he can best secure by standing behind the patient and placing his hands on either side of the head, with the fingers below the jaw; and a third assistant may be required to secure the arms and legs of the patient, especially in the case of children.

Position of the Patient and the Operator.—If it be a bright day, the patient should be placed opposite the window in the recumbent position, and on a dark day, or at night, the strongest available means of illumination should be employed; in the later stages of the operation the frontal reflector of a laryngoscope is often of great service in throwing the light into the wound. The patient's shoulders should be raised and the neck slightly thrown back over the bolster already described. In some instances, when the recumbent position produces dyspnœa, the operation must be performed with the patient sitting upright. The most convenient position for the operator is on the right side of the patient.[2]

Selection of a Suitable Canula.—The advantages of a right-angled tube have already been pointed out (page 373), and it now only remains to make a few remarks on the *size* of the tube to be selected. For adult men a No. 1 tube should be chosen; for adult women No. 2; for boys and girls from ten to fifteen years of age No. 3 generally suffices, though occasionally No. 2 can be used; under ten No. 4 can generally be employed, though under one year a smaller tube may be required.

Tracheotomy.

As already explained (page 366) there are two situations in which the trachea may be opened, viz., above and below the isthmus of the thyroid gland; the former is called "superior tracheotomy," the latter "inferior

[1] Med. Times and Gaz., December 4, 1869.

[2] When tracheotomy is performed for the purpose of plugging the trachea (as in the case of serious operations on the tongue or jaws), the patient's head, supported by an assistant, may be allowed to hang over the end of the operating table. His mouth must be held open and his tongue kept well out with blunt forceps. The operator, sitting opposite the head of the patient, makes the usual incision but in reverse (Rose: Archiv Klin. Chir., Bd. 17, 1874). It need scarcely be remarked that this method is not suited for cases in which the operation is performed to relieve dyspnœa.

tracheotomy," and as the lower operation is most frequently practised in this country, it will be first described.

Inferior Tracheotomy.—There are three stages in tracheotomy: First, to lay bare the trachea; secondly, to divide it; and, thirdly, to insert the canula.

First Stage of Operation.—Before making the first incision, the operator should inspect the neck, and notice its salient points. The prominent thyroid cartilage can generally be seen and always felt. The cricoid cartilage is also, as a rule, easily perceived with the fingers, and except in the case of very fat infants the rings of the trachea can usually be made out. In performing the operation two cardinal rules should always be borne in mind, viz., first, to operate slowly, and, secondly, to use the knife as little as possible, except for the first incision through the skin, and for the final division of the rings of the trachea. These rules, however, must of course be ignored when the dyspnœa is urgent. Under these circumstances it may be necessary to plunge the knife into the trachea without any preparatory dissection. The integument in the laryngo-tracheal region having been frozen, an incision should be made through the skin exactly in the middle line, commencing opposite the second ring of the trachea and extending downward toward the sternum. A free external incision cannot be too strongly insisted on, not only because it facilitates the subsequent stages, but also on account of its diminishing the risk of subcutaneous emphysema. The knife always penetrates through the outer layer of superficial cervical fascia, and the deep layer comes into view. On carefully dividing this layer, a loose areolar tissue, containing more or less fat and generally some engorged veins, is met with. At this stage the isthmus of the thyroid gland generally comes into view at the upper part of the wound, and in young children the thymus gland is sometimes seen below. In proceeding with the operation, the point of the knife should, as much as possible, give way to the handle; if it be found impossible to avoid a vein it should be divided between a double ligature. It is at this period of the operation that arterial hemorrhage is apt to occur, though a small vessel may be accidentally opened at an earlier stage. The bleeding can generally be readily stopped at once by pressure, or by the application of a small lump of ice, but if these measures do not succeed the vessel must be tied or twisted. If a ligature is applied both its ends should be cut short, for if one end is left it is likely to be torn away when the canula is subsequently introduced. The deep layer of the deep cervical fascia may require the point of the knife, but it can as often be cleared away with the handle.

Second Stage.—When the tracheal rings have been well exposed, the operator should open the trachea by inserting a sharp scalpel exactly in the middle line, with its edge directed upward, whilst he steadies the tube by pressing on it gently but firmly with the forefinger of his left hand. The incision should be made through two or three rings, and whilst sufficient force must be used to penetrate the tough mucous membrane, the knife must not be plunged in too deeply, for fear of wounding the posterior wall of the trachea. If the trachea is strongly ossified and the knife will not divide the cartilages, the tracheal bone forceps should be introduced through the small opening which has been made between the rings, and then carried upward. If the trachea is undergoing rapid up-and-down movements it is a good plan to insert a tenaculum into its upper part, just below the cricoid cartilage, and to draw it well forward before the incision is made. This procedure is often desirable in the case of children, owing

to the small size of the trachea. Directly the trachea is divided a hissing noise (caused by the rapid passage of air through the narrow opening) is perceived. At the same time there is frequently spasmodic irritation of the larynx and violent coughing.

Third Stage.—Immediately after dividing the trachea the operator should introduce his left forefinger into the tracheal wound, and not remove it until he has inserted the canula.[1] At this critical moment I have often seen young surgeons fail. Sometimes the difficulty arises from the tracheal rings not having been sufficiently divided, sometimes it is caused by the canula being pushed into the tissues of the neck in front of the trachea, instead of into the trachea itself. If the opening in the trachea is too small it should be slightly enlarged with the guarded bistoury, and a second attempt made to insert the canula. In order to facilitate the introduction of the canula some surgeons use Trousseau's dilator, an instrument somewhat resembling curved forceps, terminating in thickened bulb-like points. The dilator is inserted closed into the wound, and is then opened, when a space is left between the blades through which the canula can be introduced. If, however, the ordinary canula is provided with a proper pilot, the dilator is totally unnecessary. After the canula has been inserted, the operator should hold it in position until it is firmly secured with tapes. An inner tube should then be introduced into the canula, and the edges of the wound above and below the tracheal shield brought together, either by strips of plaster or stitches.

Dangers during the Operation.—The great danger during the operation is hemorrhage after the trachea has been opened, but before the canula has been inserted. This risk is best avoided by not opening the trachea until all bleeding has been arrested, and particularly by taking care (by previous thorough exposure of the trachea) that no vessel is wounded in the final incision which lays open the windpipe. The accident not unfrequently occurs in the following manner: the windpipe having been opened, the young surgeon has perhaps some difficulty in inserting the canula; he is accordingly obliged to enlarge the first opening, and in doing so wounds a vessel. By the inspiratory efforts of the patient blood is then quickly drawn into the trachea and bronchi, and in a few seconds the patient may be on the verge of suffocation. The canula must be introduced as quickly as possible, and if the blood is not quickly coughed up, the surgeon must apply his mouth to the orifice of the tracheal tube and suck out the blood, unless he should be so fortunate as to have at hand an apparatus which can effect a similar result (page 401); if, however, the surgeon has been unable to introduce the canula and the patient is in danger of being suffocated by blood pouring down the trachea, Hueter's suggestion, that a flexible catheter should be passed into the windpipe and the blood sucked up through it, may be carried out. Indeed, even if the canula has been introduced, it is sometimes more convenient to draw the blood out by a catheter passed through the canula than by applying the mouth direct to the latter. It is when blood passes into the windpipe that artificial respiration, promptly, steadily, and perseveringly carried out, is of such great value, often rescuing the patient from apparent death. But, if respiration be not quickly re-established,

[1] If the operation has been performed for the removal of a foreign body, of course no canula is introduced, but the sides of the trachea are held open by retractors, when on coughing the patient often expels the foreign body. If this does not occur, the offending substance has to be searched for and if possible extracted (see "Foreign Bodies in the Trachea").

his energy must be stimulated to the utmost by faradism. A strong current should be used, the positive electrode being placed over one of the pneumogastric nerves in the neck, and the negative electrode over the thoracic insertions of the diaphragm, whilst the intercostal muscles should be directly stimulated. As a possible danger, the entrance of air into a vein must be mentioned, but it is so rare an accident that even those who have had the largest experience in tracheotomy have never met with it. The only treatment of any avail consists in immediately compressing the vein with the finger, and thus preventing the further entrance of air; stimulants should at the same time be freely administered, and the action of the heart promoted by a strong faradic current.

After-treatment.—As soon as the tracheal canula is safely secured in the windpipe, the after-treatment must be considered. Immediately after the operation the patient should be propped up in bed or supported by a bed-rest, and if there is no tendency to hemorrhage, he should be allowed to go to sleep. Previous to the operation there has frequently been sleeplessness for several days and nights, and, as soon as it is over, the exhausted patient often falls into a long and refreshing sleep. Either before going to sleep, or as soon as he wakes, the patient should be given some beef-tea or milk, and if there is much depression a stimulant may be added; and as liquids have a tendency to pass into the windpipe he should be directed to swallow very carefully. It is a common practice to surround the patient with a warm moist atmosphere, by means of a steam kettle or other apparatus, but, except in the case of diphtheria, I do not recommend this measure. For the first three or four days after the operation the patient should be carefully watched by a competent nurse, who ought to know how to remove and replace the inner tube. If inspissated mucus collects in the canula it should be removed with a feather during the first few hours after the operation, as the changing the inner tube at this early stage is apt to disturb and pain the patient. It is better not to remove the outer tube until the third or fourth day, unless it causes great inconvenience. At this period also sutures may be removed.

Dangers following the Operation.—The most important dangers following tracheotomy are: syncope, broncho-pneumonia, secondary hemorrhage, general emphysema, cervical cellulitis, blocking of the canula, displacement of the canula, and ulceration, etc., and ulceration of the trachea. These dangers will now be briefly passed in review. Syncope is most to be feared in the case of old people and in those cases in which the operation has been too long postponed. It is often associated with carbonic acid poisoning. Broncho-pneumonia must be especially feared when the operation is performed on account of diphtheritic inflammation of the throat or air-passages. If it does not occur in the first three or four days it need not be apprehended. Secondary hemorrhage is comparatively rare, but an example has been reported by Böckel,[1] and I have myself met with two cases. In one of these the patient was operated on by Mr. Francis Mason some years ago, on account of acute laryngitis; no blood was lost during the operation, but the patient succumbed a few days afterward from secondary hemorrhage. In the other case the patient was a man sent to me by Dr. Mills, of Ipswich, in August, 1879, on whom I performed superior tracheotomy. In this case, although the hemorrhage was very severe on two occasions a week after the operation, the bleeding was ultimately arrested by the internal administration of ergot of rye. It is exceedingly

[1] De la Trachéotomie dans le Croup. Thèse de Strasbourg, 1867.

difficult to deal with these cases of secondary hemorrhage. Of course if the blood is pouring forth when the surgeon arrives, he must endeavor to find the bleeding vessel, if necessary, enlarging the wound for that purpose; but it often happens that though the hemorrhage may have been profuse, it has ceased before the practitioner can attend. Under these circumstances the wound should not be disturbed, but the nurse should be provided with a styptic solution and taught how to apply pressure at the bleeding point, in the event of a recurrence of the hemorrhage. At the same time, ergot of rye should be either administered internally or injected subcutaneously. Subcutaneous emphysema may either take place during the operation from making too small an opening in the windpipe, or may gradually come a few hours after, owing to the tracheal wound not corresponding to that in the integument, but being made on one side of the windpipe. As a rule it soon subsides spontaneously, and it is rarely necessary either to rectify the tracheal wound or to scarify the skin. Cervical cellulitis is a more dangerous but a much rarer accident. It occasionally results from using too great violence with the handle of the knife (which the surgeon very properly employs to a considerable extent, in order to avoid causing hemorrhage with the blade); and it is also not unfrequently the result of clumsiness in originally inserting the canula, the young surgeon sometimes greatly irritating the tissues whilst trying to introduce the tube. Should this complication arise, it must be treated on ordinary surgical principles, great pains being taken to prevent the burrowing of pus into the anterior mediastinum. In conclusion, attention must be called to the fact that the tube may get blocked up by inspissated mucus or false membrane, or, becoming displaced, it may be forced out of the trachea, and lie in front of it in the tissues of the neck. These complications are the result of carelessness, and ought never to occur. Ulceration of the trachea may sometimes take place as the result of the tube not fitting, but this is an accident which I have never known to happen when a right-angled tube has been used. Fracture of the canula, and its passage into the trachea, is a remote contingency which cannot be regarded as one of the legitimate dangers of tracheotomy. The subject has been briefly referred to under "Foreign Bodies in the Trachea" (page 412).

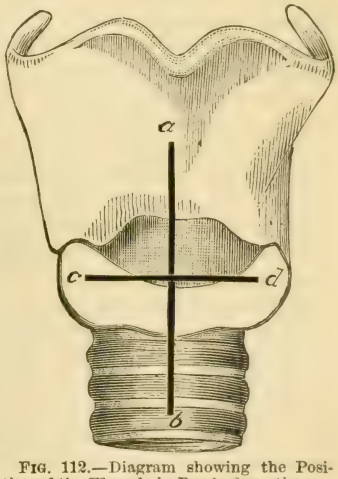

FIG. 112.—Diagram showing the Position of the Wounds in Bose's Operation.

SUPERIOR TRACHEOTOMY—From a very early period some surgeons have recommended that the trachea should be opened above the isthmus, but it has generally been considered, in the case of children at least, that there was not sufficient room in this situation. Latterly, however, the operation has been revived with some modification by Professor Bose,[1] and it is now commonly performed in Germany. The following is the mode of procedure: a longitudinal incision is made (Fig. 112, *a b*), beginning over the middle of the thyroid cartilage and carried downward to the

[1] Tracheotomia Sup., Archiv für Klin. Chirurgie, Bd. xiv. pp. 137, 147.

lower border of the proposed tracheal opening. This incision is to be carried through the skin and the subcutaneous tissue till the superior layer of the deep cervical fascia is reached. The expansion of this incision is then effected by means of a spring dilator inserted in the middle of the wound, and a horizontal incision (*c d*), about half an inch in length, corresponding to the lower border of the crico-thyroid membrane, is made through the superficial layer of the deep cervical fascia. A director is then inserted from above between the deep layer of the deep cervical fascia and the cricoid cartilage, and both layers of fascia and everything which is between them (venous plexus, isthmus of the thyroid gland) is carried down by simply raising the director. The whole field of operation being now free, the opening of the trachea is made in the usual way. It is highly probable that on account of its much greater safety this operation will entirely supersede the old operation.

Laryngotomy (Crico-thyroid).

This operation was originally suggested by Vicq d'Azyr,[1] was subsequently recommended by Fourcroy,[2] Benjamin Bell,[3] Desault,[4] Roux,[5] and Malgaigne,[6] and has recently been advocated by Timothy Holmes,[7] Roser,[8] Krishaber,[9] and Choukry.[10]

The arguments against laryngotomy especially brought forward with much ability by Mr. Marsh[11] are—(1) That the crico-thyroid space does not admit a sufficiently large tube; (2) that the insertion of a canula through the crico-thyroid membrane interferes with the integrity of the larynx, and prevents the proper tension of the vocal cords; (3) that the tube in this situation gives rise to more irritation; and (4) that the retention of a tube in the crico-thyroid space is apt to produce serious inflammation, and even necrosis of the cartilages. Most of these dangers are of an entirely chimerical kind, and the measurements of Mr. Timothy Holmes show that the lumen of the cricoid cartilage is so much greater than that of the glottis, that ample breathing room can be obtained by an opening through the crico-thyroid membrane. After perusing the details of the operation set forth in the next paragraph, it will be seen that laryngotomy is a very easy operation as compared with tracheotomy, and that the fear of hemorrhage may be almost ignored. Hence, in a sudden emergency where suffocation threatens, this operation should be performed, especially if the practitioner is alone with the patient.

In performing the operation a vertical incision should be made in the median line through the integument commencing over the centre of the thy-

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[1] Op. cit.
[2] De Novâ Laryngotomiæ Methodo, Paris, 1779.
[3] System of Surgery, 1783.
[4] Œuvres Chirurgical., 1813, t. ii. p. 276.
[5] Archiv. Méd., 1831, 1re s. t. xxvii. p. 545.
[6] Méd. Opér., l. ii. p. 291.
[7] Diseases of Infancy and Childhood, London, 1869, p. 315.
[8] Path. Chir., 1870, p. 291.
[9] Annales des Maladies de l'Oreille, etc., December, 1878.
[10] De la Trachéotomie et de la Laryngotomie Intercrico-thyroïdienne, etc. Th. Paris, 1878. An excellent historical sketch of the operation has been recently published by Dr. Nicaise (Annales des Maladies de l'Oreille, etc., December, 1878), to which I am indebted for many of the above references.
[11] St. Bart. Hosp. Reports, 1867, vol. iii. p. 331.

roid cartilage, and extending downward for an inch to an inch and a half. The crico-thyroid membrane should then be opened by a transverse incision, the crico-thyroid artery being pushed on one side by the forefinger of the left hand. On dividing the superficial layer of the deep cervical fascia, a plexus, formed by the crico-thyroid veins, comes into view, which should be pushed on one side; more rarely an extension of the thyroid gland is seen projecting from the isthmus up to the crico-thyroid space. If present this structure must be treated in the same way as the veins. In some cases, in order to obtain sufficient space, it is necessary to make a crucial incision, or even to separate the membrane from the thyroid and cricoid cartilages at every point of connection. The canula is then inserted in the manner already described in speaking of tracheotomy. As Vicq d'Azyr and Fourcroy first pointed out, it is better to use a flattened tube, that is to say, a tube with an oval instead of a circular lumen, the longer diameter of the tube corresponding to the transverse diameter of the crico-thyroid space.

Laryngo-tracheotomy.

This operation consists in carrying the incision through the crico-thyroid membrane, the cricoid cartilage, and the first one or two rings of the trachea. It is an operation which is very seldom performed, except for the removal of a large growth or foreign body from the larynx.

On Thermo-Cautery in Laryngo-Tracheal Operations.

The danger of hemorrhage in opening the trachea has always been a very serious feature in the operation, and various expedients [1] have been adopted with a view of preventing it. In 1870 Amussat [2] first made use of galvanic cautery in performing tracheotomy, but he did not publish the result till 1872, when Verneuil [3] reported the result of a similar operation; in 1874 Krishaber [4] published two cases in which he had adopted the same method for opening the trachea, and he has since reported three additional cases,[5] whilst Tilleau,[6] Voltolini,[7] v. Bruns,[8] and Böckel [9] have also recorded similar examples. Recently Paquelin's thermo-caustic knife has been used by Dr. Poinsot,[10] of Bordeaux. It appears to me that the use of thermo-cautery for opening the air-passages merely introduces an unnecessary complication into the operation. Although it reduces the chance of serious hemorrhage it does not absolutely prevent it. According to some experiments made by M. Nicaise [11] hemorrhage does not

[1] The suggestion of M. Guérin that tracheotomy should be performed subcutaneously, and that of M. Chassaignac that the operation should be carried out with the *écraseur*, must be looked upon as ingenious curiosities of surgery. It has even been recommended by Dufardin (Kühn, loc. cit.) to open the trachea by means of a caustic paste.

[2] Bull. de Thérapeutique, 1872, p. 472.

[3] Bull. de l'Acad. Méd., 1872, p. 299.

[4] Memoires de la Société de Chirurgie, 1874.

[5] Annales des Maladies, etc., tome ii. p. 67.

[6] Gaz. des. Hôp., 1874, p. 281.

[7] Berl. Klin. Woch., 1872, Nro. 41.

[8] Galvano-Chirurgie, 1870, p. 54; and Paul Bruns: Berl. Klin. Woch., 1872, Nro. 53.

[9] Ibid., December 31, 1878.

[10] Lancet, February 16, 1878.

[11] Annales des Maladies, etc., December 31, 1878.

occur when arteries having a diameter of half a millimetre to one millimetre are divided by a platinum knife heated to a dull red color, nor when veins of a somewhat larger diameter are opened, but if vessels of greater size are cut into, blood flows. It may be added that erysipelatous inflammation sometimes attacks the wound as the result of the burn. Should thermo-cautery be employed it is better to limit its use to the soft tissues, and when the trachea is reached, to open it with a scalpel. As Krishaber has pointed out, the thermo-caustic knife should not be pressed heavily against the skin, but a succession of light touches should be made.

Withdrawal of the Canula.

When tracheotomy is performed on account of acute disease, it is extremely important, especially in the case of children, to dispense with the canula as soon as the laryngeal obstruction has passed away; for if the canula is retained too long it is sometimes difficult, if not impossible, to do without it. This difficulty may arise from several causes: thus, on closing the tracheal wound, the passage of air through the larynx may give rise to spasm of the glottis, or the abductors of the vocal cords may have become paralyzed, or the laryngeal and sublaryngeal canal may have become blocked up by granulations or cicatricial contraction, or possibly the trachea may be thrown into a state of spasm, or its walls may collapse. In two cases which have come under my own notice spasm of the glottis appeared to be the essential cause of the difficulty; both the patients were young children, and in both, immediately before removing the canula, its shining surface could be easily seen with the laryngoscope through the glottis, showing that there was no paralysis of the abductors of the vocal cords. I do not, however, feel absolutely certain as to the diagnosis of these cases, and think it possible that the dyspnœa which arose when the canula was removed may have been due to partial collapse, or even to spasm of the tracheal walls above the canula. One of these patients ultimately died, but no post-mortem was permitted; the other case passed out of my hands, and I do not know what was the subsequent result. Paralysis of the laryngeal muscles (abductors) was first stated by Trousseau [1] to be a cause of difficulty in withdrawing the tracheal canula. That this condition sometimes actually arises after tracheotomy has been proved laryngoscopically by Gerhardt,[2] but I believe that it is exceedingly rare, and that most of the cases in which it has been supposed to exist, have, on the other hand, been of a spasmodic character. There is quite an extensive bibliography [3] as to the occurrence of granulations after tracheotomy in the supra-tracheal region, whilst contruction of the laryngo-tracheal canal, and the union of its opposite walls, are by no means uncommon in tertiary syphilis of this region. The spasmodic and paralytic affections can be best treated by plugging the tube for increasing periods of time and administering nervine remedies suitable in the opposite conditions. Granulations can be easily got rid of by passing gutta-percha or laminaria bougies.[4] Cicatricial contractions can sometimes be overcome to some extent by assiduous dilatation, but they generally relapse as soon as the treatment is discontinued.

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[1] See page 329.
[2] Ibid.
[3] Max Schüller: Op. cit. p. 19.
[4] Thomas Smith: Loc. cit. p. 230.

TRACHEOCELE.

Latin Eq.—Tumor aerius asperæ arteriæ.
French Eq.—Trachéocèle.
German Eq.—Tracheocele.
Italian Eq.—Tracheocele.

Definition.—An air-containing tumor situated on the front of the neck, sometimes unilateral, sometimes bilateral, communicating with the interior of the trachea by a small opening.

Etiology.—This affection is very rare, but cases have been described by Ammon,[1] Behr,[2] Rokitansky,[3] Lizé,[4] Gayet,[5] Leriche,[6] Förster,[7] Guyon,[8] Devalz,[9] Faucon,[10] Fischer,[11] and Eldridge[12] of Yokohama. The last named physician, in addition to publishing a case occurring in his own practice, has collected nearly all the recorded examples of the disease, and has written a very excellent article on the subject. The origin of the disease is extremely obscure, and it is quite possible that it may proceed from various causes. There can be no doubt that in rare cases it is due to imperfect evolution, either from defective closure of one of the bronchial clefts, or merely from feeble development of one of the intercartilaginous spaces of the trachea. In two cases[13] the disease existed from birth, and in one of these two, viz., that of v. Gohl, it was associated with an irregular development of the thyroid gland. More often the affection appears to be the result of some accidental straining. In one case[14] it appeared to originate during the act of vomiting ; in another[15] it was first perceived during an attack of bronchitis attended with violent cough. It is more frequently met with in men than in women.

Symptoms.—When present, tracheocele can scarcely fail to be recognized. During ordinary respiration there may be only a slight fulness in front of the neck ; but on forced expiration, with the mouth and nose closed, a tense tumor becomes apparent. This tumor occupies a position corresponding to a great extent to that of the thyroid gland ; sometimes it is median, sometimes on one side, whilst occasionally it is bilateral, and

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[1] D.e angeborenen chi. Krankheiten, etc. Berlin, 1842, p. 54. Ammon remarks: There is only a single instance of congenital tracheocele on record—a case very imperfectly described by Von Gohl, in which the affection was complicated with bronchocele.
[2] Wochenschr. f. d. ges. Heilkunde, Berlin, 1836, 361, 368.
[3] Oest. Jahrbücher, 16 Bd.
[4] Bull. Soc. Chir. de Paris, 1861, p. 529 et seq.
[5] Compte Rendu de la Soc. des Sciences Méd. de Lyons, 1865–6, t. 5.
[6] Ibid., 1868.
[7] Patholog. Anat., vol. ii. p. 310.
[8] Gazette Heb., June 24, 1873.
[9] Gazette des Hôp., Nov. 8, 1873.
[10] Archives Méd. Belges, Jan. 1874.
[11] Pitha and Billroth's Handbuch, Bd. 3.
[12] American Journ. of Med. Sci., July, 1879.
[13] The affection was observed by Faucon in one of his cases, in a child a year and a half old, but it had existed from birth ; the other case is that of v. Gohl.
[14] One of Faucon's cases : Loc. cit.
[15] Devalz : Loc. cit.

consists, in fact, of two tumors. In one instance the neck measured 40.5 centimetres in ordinary respiration, whilst in forced expiration, with nose and mouth closed, its circumference was 49 centimetres.[1] By pressure externally, whilst the patient stops breathing or inspires, the tumor can sometimes be effaced or prevented from forming, but as the communication with the trachea is sometimes at the back of that tube, it cannot always be commanded. Sometimes[2] on deep inspiration the tumor seems to disappear altogether, but, as a rule, the existence of the sac under the skin can be perceived with the finger even when it is not distended. A distinct impulse is conveyed to the sac when the patient coughs. In Dr. Eldridge's case, on making a fine opening with the needle into the sac, a stream of air, forcible enough to extinguish a lighted match, was emitted. In one of Faucon's cases, the tumor was tympanitic on percussion, but in most cases there has been an absence of resonance. Dyspnœa is sometimes experienced, though this is quite the exception. When present it is probably an accidental complication of a reflex character, but it may possibly be due to the compression which the distended tracheocele exerts on the windpipe when it is itself pressed on by the sterno-mastoid muscle. Phonation is, as a rule, generally merely weak, but in the case reported by Devalz, the patient's voice underwent a peculiar modification, "each syllable being accompanied with a soft murmur, which prolonged the true laryngeal sound, and surrounded it with a kind of sonorous shadow;" the sound "*ouvouvou*" (pronounced as in French), according to Devalz, gives a very good idea of this whispering noise.

Pathology.—The outer covering of the tumor varies as regards composition and thickness according as it remains under the muscles, or becomes subcutaneous. The lining wall generally resembles mucous membrane, and the sac usually contains some mucous or muco-purulent secretion.

Diagnosis.—The varying size of the tumor, its increase on forced but obstructed expiration, and the impulse conveyed to the hand when placed upon it, leave no doubt as to its nature. In all the cases recorded, there is only one in which the diagnosis was not at once arrived at, and it probably came under the notice of a practitioner who had never heard of such a condition.

Prognosis.—Tracheocele does not, as a rule, appear to be attended with much danger. Where it originates in a congenital deficiency, cure is improbable; but when it has arisen from a violent exertion, it is likely either to be cured or to disappear spontaneously.

Treatment.—As a rule, some mechanical appliance for preventing the distention and progressive development of the tumor is all that is required. In one instance, however, the sac was extirpated under the impression that the tumor (which had previously been opened by another surgeon with an escharotic) was a suppurating cervical gland.[3] The ultimate result of this case is not stated, but the dictum of Gayet, that "surgical interference would be worse than the disease," probably deserves general acceptance.

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[1] Eldridge: Loc. cit. [2] Gayet: Loc. cit. [3] Fischer: Op. cit.

FOREIGN BODIES IN THE TRACHEA.[1]

Latin Eq.—Corpora adventitia in tracheâ.
French Eq.—Corps étrangers dans la trachée.
German Eq.—Fremde Körper in der Trachea.
Italian Eq.—Corpi straniere nella trachea.

Definition.—Foreign substances lodged in the trachea, most commonly gaining access to that canal from the mouth (after having passed through the pharynx and larynx), but occasionally passing up from the stomach, and more rarely still entering from the neck.

History.—Isolated cases of foreign bodies in the air-passages have been recorded from a very early date, but the subject was not treated in a manner at all commensurate with its importance until the year 1759, when Louis[2] discussed it incidentally in a paper on bronchotomy. In 1796 Sabatier[3] devoted a short article to the same subject, and Porter[4] of Dublin, in the year 1837, treated it with considerable detail; while Albers,[5] in 1846, collected a large number of remarkable illustrative cases. The subject, however, was first dealt with in a really exhaustive manner in the year 1854, when the treatise of Professor Gross,[6] of Philadelphia, appeared. This invaluable essay gives full reports of 200 cases, and is so complete that it is doubtful whether it will ever be improved upon; indeed, the excellent articles of Bourdillat[7] and Kühn,[8] subsequently published, the former based on 300 and the latter on 374 cases, only confirm the conclusions previously arrived at by Gross.

Etiology.—The foreign bodies found in the trachea generally gain access to it through the larynx, and are usually small; or, if of any size, have a more or less rounded contour, large or irregularly shaped bodies being more likely to become impacted in the larynx. The circumstances under which foreign bodies penetrate into the trachea from above are naturally the same as those under which they gain access to the larynx, as already described (page 298). Thus children are very liable to the accident when they fall asleep with their little playthings in their mouths, and the same is true of persons of all ages who are in the habit of talking, and especially of laughing, during meals. In the latter case the accident is especially likely to happen in taking soup which contains portions of solid meat, vegetables,[9] or foreign bodies which have been carelessly ad-

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[1] Though in the "nomenclature" and "definition" the presence of foreign bodies is limited to the trachea, it will be found convenient in this article to briefly follow such substances in their peregrinations down the bronchi and into the lungs.

[2] Mém. sur Bronchotomie, Mém. de l'Académ. Roy. etc., Paris, 1760.

[3] De la Médecine Opératoire, etc., Paris, 1796. tome ii.

[4] Surgical Pathology of the Larynx and Trachea, Lond., 1837, 2d ed.

[5] Atlas der Path. Anat. und Erläuterung dazu, 1846.

[6] Foreign Bodies in the Air-Passages, Philadelphia, 1854.

[7] Gazette de Paris, Nos. 7, 9, 10, 13, and 15, 1868.

[8] Günthers: Lehre v. den blut. Operat., V. Abtheil.

[9] Heister (System of Surgery, 1743, part ii. sect. 3) quaintly describes how, by means of tracheotomy, he "happily extracted a PIECE of a boiled MUSHROOM which slipped into the TRACHEA of a jocose MAN at Helmstadt with DANGER of SUFFOCATION by LAUGHING while he was eating BROTH in which MUSHROOMS were boiled."

mitted. Sometimes the foreign substances found in the trachea are such as have passed up from the stomach in vomiting, undigested food being generally the peccant matter under such circumstances.[1] This is particularly apt to occur during the vomiting of intoxication. Dr. Smyly[2] has recorded a case of fatal suffocation, in which threadworms found their way into the larynx and trachea.[3] Sharp foreign bodies, such as pins, needles, or the bones of fish or other animals may gradually eat their way from the œsophagus into the trachea, or may be forced into it by violence in attempts to extract them.[4] Sometimes a foreign body reaches the windpipe through the defective construction of an instrument or the carelessness of a patient. Thus in one case[5] the blades of some tube forceps broke off and fell down the trachea whilst the surgeon was endeavoring to remove a laryngeal growth; and the records of cases[6] are only too numerous in which the same thing has happened to a portion of a tracheal canula, the instrument either having been defectively made or having been allowed to get into an insecure state through want of attention on the part of the patient. Lastly, the bronchial[7] or cervical[8] glands, when diseased, occasionally free themselves from their normal surroundings, and work their way into the trachea through an aperture in its wall previously caused by the prolonged pressure of the morbid structure. Cases have also been reported by Fabricius Heldamus,[9] Tulpius,[10] and others in which some of the materials used for dressing deep wounds of the chest have worked their way up into the trachea, and been finally expelled by coughing. A well-known case, by which De la Martinière has immortalized himself, is worthy of a brief record, if only for the sake of impressing on young surgeons the advantage of the closest habits of observation:

De la Martinière[11] was called one day by a brother practitioner to a little boy who had been suddenly seized with pain in the throat and shortness of breath whilst amusing himself by cracking a whip. On arriving, he discovered on the skin in front of the upper part of the trachea a minute red spot about the size of a flea-bite, on pressing which a hard swelling, feeling something like a lentil, was perceived at a considerable depth beneath the integument. He cut down upon it, and discovered a brass pin, more than one inch in length, transfixing the trachea and penetrating its posterior wall. This was extracted with tweezers. It was subsequently discovered that the boy had fastened the pin to the end of the lash, in cracking which the pin had flown off and penetrated his neck. The wound healed in a few days.

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[1] Parrot: Union Médicale, 1868.

[2] Dublin Journ. Med. Sci., May, 1866. This article also contains references to two or three other similar cases.

[3] Lancet, 1839 to 1840, p. 803.

[4] Gross: Op. cit. p. 52.

[5] Reported by Voltolini: Monatsschrift für Ohrenheilkunde, No. 12, 1879.

[6] In order to find examples of this accident, it is only necessary to look through the indexes of any of the weekly medical journals during the last ten years. Dr. Solis Cohen (Diseases of the Throat, 2d edition, p. 663) has collected a large number of illustrative cases.

[7] Edwards: Med.-Chir. Trans., vol. xxxvi.; Dr. Henry Thompson: Med. Times and Gaz., Jan. 24, 1874; and Dr. George Johnson: Brit. Med. Journ., Oct. 27, 1877.

[8] Frazer: Edin. Monthly Jour., Jan. 1848.

[9] Opera Omnia; Centuria Prima, 1682, obs. 46, p. 41.

[10] Lib. ii. Obs. xv.

[11] Selected Memoirs of the Royal Academy of Surg. of France, London, 1848, translated by Drewry Ottley.

Symptoms.—The symptoms vary greatly according to the size and shape and nature of the foreign body and the exact situation in which it is lodged. If the substance be comparatively large, or if a quantity of fluid enter the air-passages, the patient may be suddenly suffocated, and fall down dead;[1] and even if it be not quite large enough to cause instant death, it may still give rise to fatal apnœa in the course of a few minutes. Under the latter circumstances the patient is seen to be suffering from a painful attack of suffocation, which he probably tries to relieve by putting his finger down his throat, and making immense inspiratory efforts. The face soon becomes cyanotic, cold sweats break out on the body, and if immediate relief cannot be afforded death quickly takes place. Sometimes the dyspnœa is comparatively slight at the moment of the accident, but in the course of a few hours a sudden attack of suffocation comes on from change of position or from spasm of the glottis. This may cause immediate death, or it may pass off to be again repeated, perhaps with a fatal result. If, on the other hand, the offending substance be small and smooth, it may pass down the trachea and give rise to inflammation of the lungs without its ever being known that any accident has occurred,[2] or it may even remain in some part of the air-passages without ever giving rise to any serious symptoms. Thus, Royer-Collard [3] has reported the case of a lunatic, who, in eating, unconsciously drew a piece of bone into his trachea, which remained in the respiratory canal for six years without causing any inconvenience. The bone was found in the left bronchus after death, and had given rise to no structural changes. As a rule, however, if a foreign body of moderate dimensions passes into the trachea it quickly causes irritation, and is usually followed by inflammation, with the customary symptoms of acute tracheal stenosis. Much, however, depends on the form of the foreign body. As a rule, if it is smooth and round, it only gives rise to slight irritation; whilst, if angular, its presence is quickly resented.

When the dyspnœa is at first very severe but soon passes off without the foreign body having been extruded, it may be inferred [4] that the offending substance was originally impacted in the larynx, but subsequently passed down the trachea. And even if the foreign substance at once passes into the trachea, the gravity of the symptoms depends to a great extent on the exact situation at which it becomes impacted; the dyspnœa, of course, is not nearly so urgent when the orifice of only one of the bronchi is blocked up, as when the canal of the trachea itself is considerably obstructed. The part of the air-passage in which the foreign body becomes fixed has been already stated (page 300) as regards 166 of Bourdillat's cases, and it need only be remarked here that the position of the bronchial spur—somewhat to the left of the median line (see "Tracheoscopy")—causes foreign bodies to pass rather more readily into the right bronchus than the left, the proportion being about as 5 to 3. Sometimes on coughing or expiring vigorously the foreign body can be felt externally by the surgeon's fingers moving up and down in the trachea, and two excellent illustrations of this phenomenon have been recorded by Mr. Couper.[5] More frequently, though the movement cannot be recognized by the surgeon, it can be felt by the patient. Occasionally the foreign body has

[1] Cline: Med. Gazette, vol. xxii. p. 38.
[2] Renaldine: Amer. Journ. of Med. Sci., i. p. 231.
[3] Nouvelle Bibliothèque Médicale, 1826, t. i. pp. 196, 200 et seq.
[4] See an illustrative case by Monckton: Brit. Med. Journ., 1862, vol. i. p. 437.
[5] Brit. Med. Journ., vol. i. p. 153, Feb. 12, 1870.

been known to be forced up from one bronchus into the trachea and ultimately to pass into the opposite lung. These movements of the foreign body are sometimes followed by expulsion; sometimes by its impaction in a more dangerous situation.

In some cases foreign substances, which when first swallowed appeared to be comparatively innocuous, become dangerous from swelling, or from forming the nuclei of concretions. Beans not only swell, but even sprout, and a grain of corn has also been known to commence germinating.[1] Velpeau[2] records a case in which a bean swelled to treble its size in a few days, and Sheppard[3] relates another in which a piece of ginger became softened and swollen. A foreign body in the trachea often gives rise to flapping or whistling sounds, and if it blocks up one bronchus more than the other, the lung on the obstructed side will generally afford evidence of the condition on auscultation, there being diminished fremitus and absence of respiratory murmur on the affected side. This, however, is not an invariable rule, for in the case of Brunel,[4] though pain was felt in a situation corresponding to the lower portion of the right bronchial tube, and an examination with a probe (after tracheotomy) proved that the foreign body—a half-sovereign—was not in the trachea, *no difference between the two sides of the chest could be detected with the stethoscope.* Probably in this case the coin was immovably fixed with its edge at right angles to the long axis of the bronchus, resting, perhaps, against one of the walls of the tube. With the laryngoscope the foreign substance may sometimes be seen; on different occasions I have had the opportunity of observing in the windpipe a plum stone, a small piece of jet, and a button.

It has already been pointed out that foreign bodies sometimes pass through the air-passages and become lodged in the tissue of the lungs, a result especially likely to occur in the case of bearded grain.[5] Under such circumstances they may give rise to serious inflammation, or even gangrene, or abscess,[6] and in fortunate cases the foreign body may be ultimately evacuated through the lateral walls of the thorax. Occasionally it would appear that the development of tubercle[7] may follow, just as when foreign substances have been experimentally introduced into the air-passages of guinea-pigs.

Diagnosis.—As a rule, the history of the case is known, and the only question to determine is the site at which the foreign body is lodged. Occasionally, however, it is impossible to elicit any information as to the antecedents of the case. Thus, in children,[8] the circumstance that a for-

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[1] Gross: Op. cit. p. 39 (several other examples are given by this author); see also Pacific Med., Journal, June, 1871.

[2] Ibid.

[3] Lancet, 1845.

[4] Trans. of Med.-Chir. Soc., vol. xxvi. p. 286. For further particulars of the case see page 416.

[5] Two cases are recorded by Sir Thomas Watson: Prin. and Prac. of Physic, fourth edition, vol. ii. p. 259. Other cases have been reported by Gross: Op. cit. p. 36; and Johnson: Lancet, 1878, vol. ii. pp. 824 and 867.

[6] See a case reported by Gross: Op. cit. p. 247, and the case by Johnson referred to in note 2.

[7] See two cases cited by Gross: Op. cit. p. 66; and a third by Royer-Collard: Nouv. Bibliothèque Méd., t. i. 1826.

[8] Porter (Path. of Lar. and Windpipe, 1837, p. 193) reports a remarkable case in which a little girl was knocked down and run over by a jaunting car, the wheel of which passed over her chest. The breathing became embarrassed and croupy, and the child died thirty-eight hours later. After death, the larynx was found to contain an almond shell, which was no doubt in her mouth at the time of the accident. There was no injury to the thoracic organs.

eign body has passed into the air-passages may be unknown; whilst in adults the suffocation may be so imminent that the patient may not be able to describe what has happened, or, again, the accident may happen to an intoxicated person. If the laryngoscope can be used, a foreign body may, as already remarked, be seen in the trachea; whilst sometimes although the offending substance cannot be actually perceived in the windpipe, yet the laryngoscopic examination may afford valuable negative evidence by showing that it is not in the larynx. Where the foreign substance passes down one of the bronchi, the dyspnœa is not generally so severe as when it remains in the trachea, and the symptoms do not usually become very pronounced until some inflammation has been set up. The absence or diminution of the respiratory murmur over one lung indicates either that the foreign body is located in the corresponding bronchial tube, or else that it is situated at the lower part of the trachea in such a way that it more or less completely covers the bronchial orifice.

Prognosis.—The prognosis must always be serious as long as the foreign body remains in the air-passages, the gravity of the case depending on the nature of the foreign body, the amount of dyspnœa, or the intensity of the disease which has been set up. Mr. Erichsen [1] has pointed out that after the immediate danger has passed away, the greatest risk occurs between the second day and the end of the first month; that during the next month the mortality diminishes, but that later on it again increases. If the foreign substance is ejected after it has remained in the air-passages only for a few days, rapid recovery generally takes place, and the same result may follow its expulsion even after months [2] or years.[3] In the latter case, however, recovery is not invariable, for the patient may die from the organic disease which has been set up.[4] In the case of children it must not be forgotten that the expulsion of the foreign body does not necessarily imply that the air-passages are free from obstruction, for a number of cases are on record in which the ejection of one foreign substance, immediately on the performance of tracheotomy, has been subsequently followed by the expulsion of other bodies a few days or weeks later. This results from the child having drawn into its windpipe several substances, either in succession, or at the same time.[5] The foreign substance sometimes becomes encapsulated, and the case in which a foreign body remained in the air-passages for sixty years may be adduced to encourage patients when extraction cannot be effected.

In this case, a boy,[6] aged three years, received into his air-passages a piece of bone, which was expelled sixty years later in a fit of coughing. The patient suffered at irregular intervals from hæmoptysis, purulent expectoration, and for a long time from cough and dyspnœa; but from the age of twenty-eight to forty-eight he was well enough to do a little work. The bone which was ultimately expectorated was "three-fourths of an inch in length, one-fourth in breadth, and one-twelfth in thickness, of an oblong triangular shape, smooth and convex on one side, and rough on the other." It was probably much larger when it originally passed down the air-passage.

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[1] The Science and Art of Surgery, seventh edition, vol. i. p. 611.
[2] Howship: Pract. Obs., Lond., 1816.
[3] Halmar: Lond. Med. Journ., vol. viii.
[4] Gross: Op. cit. p. 176, gives eight cases illustrating this point.
[5] Ibid., p. 37 et seq.
[6] Gross: Op. cit. p. 172.

Treatment.—The first object of the practitioner should be, if possible, to remove the foreign body, and if the symptoms are at all severe, tracheotomy should be immediately performed. Directly the windpipe is opened, the sides of the wound should be held back by retractors, when the foreign body will often be coughed out through the tracheal opening or the mouth. If the operator has an assistant to help him, he can make use of the ordinary retractors, but otherwise self-acting elastic retractors (see page 376) should be employed. If the offending substance is not at once expelled it should, if possible, be seized with forceps. Professor Gross has invented a special forceps for this purpose, constructed on the ordinary principles of such instruments, that is to say, consisting of two blades with handles, the shanks of which are riveted together. Professor Gross's forceps are made of soft silver, and are of very slender dimensions, but for efficiency they are not to be compared to those forceps which are closed by means of a tube passing over their shoulders. My tube-forceps (see Fig. 46) are recommended by Durham[1] for this purpose, and will be found to answer well. The longest blades are 3½ inches below the angle, but for exploring the right and left bronchi, this portion of the instrument should be at least five inches in length. Mr. Gant[2] has well pointed out that if the foreign body is loose in the trachea, chloroform should not be administered, but that if it is impacted the administration of a general anæsthetic will facilitate extraction with forceps. If the foreign body cannot be found, the edges of the tracheal wound should be stitched to the tissues at the side of the neck on each side, and for obvious reasons a canula should not be inserted. If the symptoms are not severe, a careful tracheoscopic examination should be made, as the mirror will sometimes enable the practitioner not only to see the foreign body, but to remove it.

A very remarkable case, showing the value of tracheoscopy, has recently been reported by Professor Voltolini.[3] A threaded needle, held by a man in his mouth, was, in laughing, suddenly drawn into the windpipe. The needle was seen with its point in the anterior wall of the trachea, just above the bifurcation, whilst the thread, fortunately double, extended upward, and a loop of it was loosely thrown over the arytenoid cartilages. Voltolini by seizing the thread with forceps, succeeded in raising the needle to a position just below the vocal cords, whence it was quickly coughed up by the patient. The needle measured 3.3 centimetres, and the thread was 9 centimetres in length.

Inversion, or placing the patient head downward, is a plan of treatment which probably suggested itself in the infancy of surgery, and, as Gross observes, "has probably been practised from time immemorial." It is a curious fact that the first recorded illustration of the operation is due to the greatest English architect, and that the most celebrated example of its success is the case of one of the greatest English engineers. On January 10, 1678, Sir Christopher Wren reported to the Royal Society a case of a man who, "swallowing a bullet down into his lungs, had been freed from the same long after by a person, who turned him with his heels upward, and shook him, and thereby making him cough, occasioned the bullet to fall back into his epiglottis (*sic*), and from thence by the cough to be

[1] Holmes' System of Surgery, vol. ii. p. 491.
[2] The Science and Practice of Surgery, 2d ed., vol. ii. p. 354.
[3] Monatsschrift für Ohrenheilkunde, Jahrgang xii. Nro. 12.

thrown out with great violence, and who had no further mischief thereby."[1] But the wide recognition which this method of treatment has obtained in this country is due to the great public interest which was excited in the case of Brunel,[2] who, in 1843, whilst amusing some children, let a half-sovereign slip into his windpipe. Tried before the trachea was opened, inversion gave rise to threatenings of suffocation, but after tracheotomy, the method was successful in the first trial.

If tracheotomy has been performed, inversion can always be carried out with safety, but even without this precaution it should be tried when the dyspnœa is not urgent in the case of coins and similar bodies whose weight and shape would favor their escape through the glottis. In carrying it out, the operator must be prepared to perform tracheotomy immediately if the foreign body, through change of position or by causing spasm of the glottis, should give rise to serious dyspnœa. Dr. Padley,[3] of Swansea, has described an excellent method by which the inversion can be effected; and he has well pointed out that when this method is adopted, the supine position favors the exit of the foreign body through the broad end of the triangular glottis being below. Dr. Padley's plan is as follows: A strong bench having been fixed, with the legs of one end on a couch and the others on the floor, the patient is made to sit on the upper part of it, with his knees fixed over the end. He is then directed to lie back upon the inclined plane. Not only does the supine position, as already remarked, favor the exit of the coin, but it enables the patient by his own effort to regain the upright position by using his knees as a fulcrum, and thus diminishes the danger if spasm supervenes. Dr. George Johnson[4] suggests that when a patient is inverted with the view of shaking out a foreign body, he should be directed to inspire deeply, in order to open the glottis as widely as possible; whilst, on the other hand, he must be strictly enjoined not to speak, as the vocal cords being brought together by such an act, the exit of the foreign body would be prevented.

MALFORMATIONS OF THE TRACHEA.

Latin Eq.—Deformitates ingenitæ tracheæ.
French Eq.—Vices de conformation de la trachée.
German Eq.—Missbildungen der Trachea.
Italian Eq.—Vizi di conformazione della trachea.

Definition.—Congenital deviation from the normal formation of the trachea, occurring in monsters, and the non-viable fœtus, consisting in absence, obliteration, and doubling of the tube.[5]

Those malformations which consist in the deficiency of some of the tracheal cartilages, or in the coalescence of several together, are of such little importance that they do not require any special notice, while most

[1] Birch: Hist. Roy. Soc., vol. iii. p. 381.
[2] Loc. cit.
[3] Lancet, vol. ii., 1878, p. 539.
[4] Ibid.
[5] Malformations in which there is a communication between the trachea and gullet will be treated in the section devoted to the Œsophagus, and those in which there is a fistulous opening externally will be considered under Diseases of the Neck.

of the other irregularities are of such a nature that life is incompatible with them. In anencephalous monsters the trachea is occasionally absent. Meckel[1] has collected from the writings of Blanchot, Gilibert, and Klein, three such cases, and Albers has added a fourth, reported by Prochaska. Albers also mentions the case of a double-headed monster with one trunk, in which the trachea was double in its upper part and single lower down. Meckel also reports a case by Otto, in which the trachea was completely obliterated; while in a case placed on record by Mondière,[2] a similar condition was associated with absence of the pharynx and œsophagus. Colby[3] gives an example in which there was no other malformation than an absence of the trachea, the rima glottidis leading into a small sac not half an inch in length; and lastly, Rossi has related an example of malformation in which the bronchi, at their origin, were incompletely blocked up by a cartilaginous diaphragm.

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[1] For this reference and others which are not given, see the article on Malformation of the Larynx, page 362.

[2] Arch. Gén. de Méd., Août et Sept. 1833.

[3] Med. Times and Gaz., 1862, vol. ii. p. 236.

APPENDIX.

SPECIAL FORMULÆ FOR TOPICAL REMEDIES,

MOST OF WHICH ARE CONTAINED IN THE THROAT HOSPITAL PHARMACOPŒIA.

Those Formulæ which are printed in black type have been found of especial use by the author.

STEAM INHALATIONS.

STEAM inhalations are probably more useful than any other class of local remedies that can be employed by the patient himself. They are of the greatest service in all acute inflammatory affections of the throat, and also in most chronic affections of that organ. They can be employed with any of the inhalers already described (pages 182 et seq.), or with those of a similar character, and should, as a rule, be used at a temperature of 140°, rarely over 150°, never over 160°. Under 130° they are of little use, unless ammonia is used. The inhalations which the author employs, and which he has introduced into the Throat Hospital Pharmacopœia, are mostly made with volatile oils, the oil being held in suspension in water by means of light carbonate of magnesia, in the proportion of half a grain of magnesia to a minim of oil. It has been found convenient to have the inhalation mixtures reduced to a uniform standard of one ounce, a teaspoonful of which constitutes the ordinary dose. The following is a specimen formula:—

℞. Ol Pini Sylvest., ♏ xl.
Magnes. Carb., gr. xx.
Aquæ, ℥ j.

A teaspoonful in a pint of water at 140°. To be inhaled for five minutes night and morning. (Six inspirations should be taken in a minute.)

Stimulants.

(Strong.)

Vapor Ammoniæ (Liquor. Ammon., sp. gr. .959, et Aquæ, part. æquales).
" **Calami Aromatici** (Ol. ♏ v., ad ℥ j.).
" Chlori. (Vap. Chlor., P.B.).
" Iodi. (Tr. Iod. Co. ♏ x., repeated twice or thrice during each inhalation).

(Medium.)

Vapor Acidi Carbolici (gr. xx., ad Aquæ Callid. Oj.).
" Acidi Sulphurosi (P.B.).
" Cajuputi (Ol. ♏ viij., ad ℥ j.).
" Camphoræ (Sp. Camph. ʒ j., Sp. Rect. ʒ iij., Aquam ad ℥ j.).
" Cassiæ Ol. ♏ vj., ad ℥ j.).
" Cinnamomi (Ol. ♏ vj., ad ℥ j.).
" **Creasoti** (♏ xl., ad ℥ j.).
" **Cubebæ** (Ol. ♏ xl., ad ℥ j.).
" Origani (♏ v., ad ℥ j.),
" **Salviæ** (♏ x., ad ℥ j.).
" Thymolis (gr. vj., Sp. Rect. ʒ j., Mag. Carb. Lev. gr. iij., Aquam ad ℥ j.).

(Mild.)

Vapor Cubebæ c. Limone (Ol. Cubeb. ♏ xxx., Ol. Limon. ♏ x., ad ℥ j.).
" **Juniperi Anglici** (♏ xx., ad ℥ j.).
" **Myrti** (♏ vj., ad ℥ j.).
" **Pini Sylvest.** (Ol. ♏ xl., ad ℥ j.).

Sedatives.

Vapor Ætheris (Æther, Sp. Rect., part. æqual.).
" Ætheris Acetici (Acet. Æther, Sp. Rect., part. æqual.).
" **Aldehydi** (♏ lxxx., ad ℥ j.).
" **Benzoini** (Tr. Benzoin. Co.).
" Chloroformi (Chloroform., Sp. Rect., part. æqual.).
" Conii (Succus Conii ʒ ij., Sodæ Carb. Exsiccatæ gr. xx., Aquam Callidam ad ℥ xx.).
" Lupuli (Lupulin ʒ ss.).
" Santali (Ol. ♏ vj., ad ℥ j.).

Antispasmodics.

Vapor Acidi Hydrocyanici (ʒ j., ad ℥ j.).
" Ætheris (Æther., Sp. Rect., part. æqual.).
" Amyl Nitritis (♏ viij., ad ℥ j.).

Antiseptics.

Vapor Acidi Carbolici (*see* Stimulants).
" Chlori (P.B.).
" Creasoti, Juniperi, Thymolis } (*see* Stimulants).

SPRAY INHALATIONS.

Spray inhalations are especially indicated in cases of relaxation of the mucous membrane of the pharynx and air-passages. The lactic acid and lime-water sprays are useful in diphtheria, and the strong astringents are often of service in hæmoptysis. As a rule, spray inhalations are contra-indicated when there is dyspnœa.

Astringents.

Vapor Acidi Tannici (gr. iij., ad ℥ j.).
" Aluminii Chloridi (Liquor, Throat Hosp. Pharm., ♏iij., ad ℥ j.).
" Aluminis (gr. viij., ad ℥ j.).
" Ferro-Aluminis (gr. iij., ad ℥ j.).
" **Ferri Perchloridi** (gr. iij., ad ℥ j.).
" Ferri Sulphatis (gr. ij., ad ℥ j.).
" Potass. Chloratis (gr. xx., ad ℥ j.).
" **Zinci Chloridi** (gr. ij., ad ℥ j.).
" Zinci Sulphatis (gr. ij., ad ℥ j.).

Sedative.

Vapor Acidi Hydrocyanici (℥ j., ad ℥ j.).
" Aquæ Lauro-cerasi (P.B.).
" Potass. Bromid. (gr. xx., ad ℥ j.).

Hæmostatics.

Vapor Acidi Tannici (gr. x., ad ℥ j.).
" Ferri Perchlor. (gr. v., ad ℥ j.).

Antiseptics.

Vapor Aluminii Chloridi (Liquor, Throat Hosp. Pharm., ♏iij., ad ℥ j.).
" **Acidi Carbolici** (gr. iij., ad ℥ j.).
" **Acidi Lactici Medicinalis** (♏xx., ad ℥ j.).
" **Calcis** (Lime Water, P.B.).
" Potassæ Permanganatis (gr. v., ad ℥ j.).
" Potass. Chloratis (gr. xx., ad ℥ j.).
" Sodii Chloridi (gr. v., ad ℥ j.).

FUMING INHALATIONS.

Fuming inhalations are specially indicated in cases of spasm of the larynx, trachea, and bronchial tubes. They can best be carried out by steeping unsized paper in a solution of nitrate of potash of definite strength, cutting the paper into strips of three inches long by half an inch broad, lighting the paper and dropping it into a cylindrical vessel from which smoke can be inhaled. It will be found convenient to have three solutions—(No. 1) 30 grains to the ounce; (No. 2) 45 grains to the ounce; and (No. 3) 60 grains to the ounce. A particular character may be given to these papers by the addition of various volatile principles. Thus, camphor and cassia increase their powers, whilst benzoin, sandal, and sumbul reduce their action and make them less irritating. The medium strength paper (No. 2) is generally employed in these cases, and the best method of preparing it is to moisten the paper in a tincture, or, in the case of essential oils, in a solution of the oil (1 drachm dissolved in 9 drachms of rectified spirit), and then to expose it for a few minutes in order to allow the spirit to pass off.

These papers should be kept in tinfoil, or prepared in small quantities as required.

The following are the preparations found most useful:—

No. 2 Nitrated Papers with Compound Tincture of Benzoin.
" " Spirit of Camphor.
" " Oil of Cassia.
" " Oil of Cinnamon.
" " Oil of Sandal.
" " Tincture of Sumbul.

GARGLES.

The use of gargles is too well known to require any explanation, but the author has never found them of service in diseases situated behind the anterior pillars of the fauces. Their employment is especially indicated in chronic affections, the tension necessary for the execution of gargling being often injurious in cases of acute inflammation.

Stimulants.

Gargarisma Acidi Acetici (Acid. Acet. Dil. ♏xv., Glycerini ♏xviij., Aquæ ℥ j.).
" Acidi Carbolici (*see* Antiseptics).
" Acidi Hydrochlorici (Acid. Hydrochl. Dil. ♏xij., Glycerini ♏xxiv., Aquæ ℥ j.).

Astringents.

Gargarisma Acid. Tan. Com. (Acid. Tannic. gr. xij., Sp. Rect. ♏vj., Mist. Camph. ℥ j.).
" Acid. Tan. et Gall. (Acid. Tan. gr. ccclx., Acid. Gallic. gr. cxx., Aquæ ℥ j.).
" Aluminii Chloridi (Liquor, Throat Hosp. Pharm., ♏xij., ad ℥ j.).
" **Aluminis** (gr. viij., ad ℥ j.).
" Aluminis c. Acid. Tannic. (Alum. gr. vj., Acid. Tannic. gr. viij., Aquæ ℥ j.).
" Boracis (Boracis gr. xxiv., Glycerini ♏xxiv., Tr. Myrrhæ gr. xxiv., Aquæ ℥ j.).
" Ferro-Aluminis (gr. viij. ad ℥ j.).
" Hydrarg. Perchlor. (Hydrarg. Perchlor. gr. ¼, Glycerini ♏xxiv., Aquam ad ℥ j.).
" **Krameriæ** (Infusion. ℥ ss., ad Aquæ Callidæ Oj.).

Sedative.

Gargarisma Potassii Bromidi (gr. x., ad ℥ j.).

Antiseptics.

Gargarisma Acidi Acetici (Acid. Acet. Dil. ♏xv., Glycerini ♏xviij., Aquæ ℥ j.).
" Acidi Carbolici (Acid. Carbolic. gr. ij., Glycerini ♏xxiv., Aquæ ℥ j.).
" **Potassæ Chloratis** (gr. xij., ad ℥ j.).
" **Potassæ Permang.** (Liquor, P.B., ♏vj., ad ℥ ij.).
" Sodæ Chloratæ (Liquor, xxiv., ad ℥ j.).

LOZENGES.

The lozenges in the Throat Hospital Pharmacopœia are, with the exception of carbolic acid and marshmallow, all made with "fruit paste" (a well-known article of commerce with which lozenge manufacturers are quite conversant), tragacanth, and a small quantity of refined sugar.

The following is a specimen of the composition of these lozenges, Rhatany being taken as an example:—

℞.—Extract of Rhatany in powder, grs. 1050
Tragacanth " " 70
Refined Sugar " " 280
Red Currant Paste as much as is sufficient.

Mix the dry ingredients, then add the red currant paste until the whole mass weighs 1 lb.; divide into 350 lozenges of 20 grains each, and dry them in a hot-air chamber. Each lozenge contains 3 grains of extract of rhatany.

Dose—1 lozenge every 3 or 4 hours.

Stimulant.

Trochiscus Acidi Benzoici (gr. ss., ad troch.).
" Acidi Carbolici (gr. j., ad troch.).
" **Cubebæ** (gr. ss., ad troch.).
" **Guaiaci** (gr. ij., ad troch.).
" Potassæ Chloratis (gr. iij., ad troch.).

Astringent.

Trochiscus Acidi Tannici (gr. iss., ad troch.).
" Catechu (gr. ij., ad troch.).
" **Kino** (gr. ij., ad troch.).
" **Krameriæ** (gr. iij., ad troch.).

Sialagogue.

Trochiscus Potass. Tart. Acid. (gr. iij., ad troch.).
" Potassæ Cit. (gr. iij., ad troch.).
" **Pyrethri** (gr. j., ad troch.).

Sedative.

Trochiscus Ammonii Chloridi (gr. ij., ad troch.).
" Boracis (gr. iij., ad troch.).
" Lactucæ (gr. j., ad troch.).
" Sedativ. (Ext. Opii gr. $\frac{1}{10}$, ad troch.).

Emollient.

Trochiscus Althææ (*Pastille Guimauve*).

Antiseptic.

Trochiscus Acidi Carbolici (gr. j., ad troch.).
" **Potassæ Chloratis** (gr. iij. ad troch.).

PIGMENTS.

The use of pigments is especially indicated in chronic and mild subacute affections of the pharynx and larynx; in cases of acute inflammation, on the other hand, they almost always do harm. Their special advantage consists in it being possible to apply them exactly to the diseased surface, and to limit their action to that spot.

Stimulant.

Pigmentum Argenti Nitratis (gr. xxx., ad ℥ j.).
" **Cupri Sulphatis** (gr. xx., ad ℥ j.).
" Ferri Perchlor. Fort. (℥ ij., ad ℥ j.).

Astringent.

Pigmentum Aluminii Chloridi (Liquor, Throat Hosp. Pharm., ♏ xv., ad ℥ j.).
" **Zinci Chloridi Dil.** (gr. xv., ad ℥ j.).
" Zinci Sulphatis (gr. xv., ad ℥ j.).
" Acidi Tannici (Glycerini, P.B.).
" Ferro-Aluminis (gr. lx., ad ℥ j.).
" **Ferri Perchlor Dil.** (℥ j., ad ℥ j.).
" Ferri Sulphatis (gr. lx., ad ℥ j.).

Sedative.

Pigmentum Boracis (Glycerini, P.B.).
" Amyli (Glycerini, P.B.).

Antiseptic.

Pigmentum Acidi Carbolici (gr. xxx., ad ℥ j.).
" **Aluminii Chloridi** (♏ xv., ad ℥ j.).
" Acidi Carbolici (Glycerini, P.B.).
" **Tolu** (Balsam. Tolutan. gr. lxxx., Æther. ad ℥ j.).

INSUFFLATIONS.

Insufflations are of great use in all acute and painful affections of the pharynx, larynx, and trachea. In laryngeal phthisis morphia insufflations greatly prolong the life of the patient and save him much suffering. In tracheal affections insufflations are the most valuable class of remedies that can be employed. Where the medicament consists only of a small quantity of a fine powder, as in the case of morphia, it is convenient to give bulk to it by the use of half a grain of starch, gum, or sugar of milk; the starch, however, in my experience, answers best.

Insufflatio Acidi Tannici (gr. ij.).
" **Aluminis** (gr. ij.).
" Ammonii Chloridi (gr. ij.).
" **Bismuthi Carb.** (gr. ij.).
" Boracis (gr. iij.).
" **Iodoform.** (gr. j.).
" **Morphiæ** (gr. $\frac{1}{16}$, $\frac{1}{8}$, $\frac{1}{4}$, $\frac{1}{2}$).
" Plumbi Acetatis (gr. j.).

NUTRITIVE ENEMA.

As a considerable number of patients suffering from throat diseases are unable to swallow, it is of the greatest importance, in treating these affections, that the best means of introducing nourishment into the system *per rectum* should be at the command of the practitioner. The formula given below is a slight modification of that published by Leube[1] in 1871. I commenced experiments with nutritive enemata in January, 1872, and in 1874 arrived at the conclusion that the following was the best formula; since then I have constantly used it.[2]

Cooked beef, mutton, or chicken,	3 ounces 7 drachms.
Sweetbread	1 ounce 7 drachms.
Fat	6 drachms.
Brandy	2 drachms.
Water	3 ounces.

These ingredients, mixed together, will measure 9 ounces. The meat, sweetbread, and fat must be first passed through a fine mincing-machine and then be rubbed up, with the water gradually added, to make a very thick paste. The enema should be given at a temperature of 90° to 95°, and *ought not to be administered more than twice in twenty-four hours.* The rectum should be washed out twice or three times a week with tepid water, three or four hours before giving the nutritive injection.

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[1] Deutsches Archiv f. Klin Medicin, No. xx. 1871.

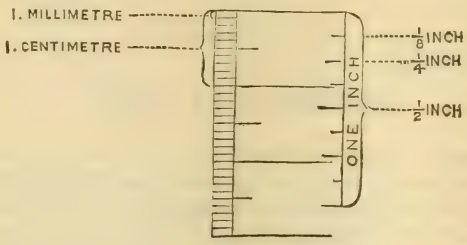
[2] The ordinary elastic bottle enema, with a tube half an inch in bore, answers the purpose very well. It is supplied by Messrs. Mayer & Meltzer, instrument makers to the Throat Hospital.

METRIC MEASUREMENTS

COMPARED WITH

THE ENGLISH INCH.

THE subdivisions of the metre having been used in this book, as well as the fractions of an inch, I have thought it convenient to place the two scales in comparison.



A millimetre is the $\frac{1}{1000}$ part of a metre.

A centimetre is the $\frac{1}{100}$ part of a metre.

A metre=1 *yard* $3\frac{3}{8}$ *inches* (or more exactly $39\frac{37}{100}$ inches).

A centimetre=rather more than $\frac{3}{8}$*ths of an inch* (or more exactly $\frac{39}{100}$ths of an inch[1]).

$2\frac{1}{2}$ *centimetres*=not quite 1 *inch* (or not quite $\frac{39}{40}$ths of an inch[2]).

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[1] The precise fraction is $\frac{3937}{1000}$.

[2] The precise fraction is $\frac{3937}{4000}$.

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A MANUAL OF DISEASES

OF THE

THROAT AND NOSE

INCLUDING THE

PHARYNX, LARYNX, TRACHEA, ŒSOPHAGUS, NOSE AND NASO-PHARYNX

BY

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TWO VOLUMES IN ONE

VOL. II.—DISEASES OF THE ŒSOPHAGUS, NOSE AND NASO-PHARYNX

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PREFACE.

It is now nearly twelve years since this work was commenced, and during that period there is scarcely a page that has not been written and rewritten many times. This slow rate of progress has been due partly to the inevitable delay caused by the many other demands on my time, and in part also to the rapid development of a new specialty involving frequent modification of views, and bringing constant additions to the literature of the subject.

No one can be more keenly aware than myself how great a gulf is fixed between the conception and the actual execution of my design, and in a book of such extent numerous errors must, in spite of the utmost vigilance, have escaped my notice. I confess that had I foreseen how much time and trouble the work, imperfect as it is, would have cost me, I should never have had the courage to undertake it. Even now I am unable to issue the volume in its integrity as originally planned, the section of Diseases of the Nose and Naso-Pharynx having grown under my hands to such dimensions that it has been found impossible to include Diseases of the Neck. I hope, however, that this division, the greater part of which is already in print, will shortly appear in a separate form as one of my series of "Essays on Throat Diseases."

I have once more to express my thanks to several friends and assistants who have aided me in clinical investigations and literary researches, and in particular I must acknowledge my deep obligations to Mr. C. L. Taylor for his invaluable help during the last four years.

Mr. Mark Hovell has again been good enough to prepare an index to the book, and the careful way in which he has performed this most useful task cannot fail to be gratefully appreciated by those who have occasion to refer to these pages.

Dr. Felix Semon's translation will be published simultaneously with the original, and it is, naturally, a source of much gratification to me that my labors should be made known to my fellow-workers in Germany by so thoroughly able an exponent.

M. M.

19 Harley Street, Cavendish Square,
London, April, 1884.

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A MANUAL

OF

DISEASES OF THE THROAT AND NOSE.

SECTION IV—THE GULLET.

ANATOMY OF THE GULLET.

The gullet or œsophagus is that portion of the alimentary canal which connects with the pharynx and the stomach. It commences at the *lower border* [1] of the cricoid cartilage on a level with the inferior margin of the body of the fifth cervical vertebra, and passing downward behind the trachea in an almost vertical direction, traverses the lower part of the cervical region, and the whole of the thorax, and after piercing the diaphragm opposite the ninth dorsal vertebra, terminates in the stomach opposite the tenth (ninth dorsal spine).[2]

[1] The distinction between the pharynx and the gullet is, of course, purely arbitrary. Most anatomists consider that the œsophagus commences on a level with the lower border of the cricoid cartilage, but Quain (Elements of Anatomy, vol. ii., p. 821) makes the cricoid cartilage generally, without specifying any border, the limit of the upper extremity of the œsophagus. Mouton (Du Calibre de l'Œsophage, Paris, 1874), in his laborious measurements of the gullet, does not clearly define its upper limit, but he appears to take an imaginary transverse line running across the middle of the posterior plate of the cricoid cartilage as the point of origin of the œsophagus. It would, however, be much more convenient to make the *upper* border of the cricoid cartilage the boundary line between the two sections of the food-tract. The sudden diminution in the calibre of the canal at this point makes, as it were, a natural division. At present, however, the lower border of the cricoid cartilage is so much more commonly accepted as the level at which the gullet commences, that I have thought it better to adhere to it. From the fact, however, that the cricoid cartilage moves up or down, according to the position of the head, some anatomists object to taking any portion of it as the upper limit of the œsophagus. Middeldorpf (De polypis œsophagi, Vratislaviæ, 1857, p. 2), indeed, goes so far as to say that the extent of movement amounts to 4 ctm. when the head is thrown far back. This circumstance has led some writers to make one of the vertebræ the limit marking the upper extremity of the gullet, but the difficulty of recognizing the exact position of the cervical vertebræ during life more than neutralizes any advantage gained by this means.

[2] It may be useful to note that as the spinous processes in the *dorsal region* are directed downward, the spine of one vertebra corresponds with the body of that im-

The œsophagus is often described as following the antero-posterior curves of the spinal column in its descent. This is true in the cervical region, but the backward curve which is usually described as occurring in the dorsal region does not exist in the erect position of the body. In the upper part of its course the gullet is in the median line, but as it descends it curves slightly to the left until it reaches the root of the neck; at this point it inclines again toward the middle of the spinal column, which position it reaches opposite the fourth or fifth dorsal vertebra. Immediately before traversing the diaphragm it makes a short curve forward and slightly to the left. Owing to the very loose attachments of the œsophagus, the relations of the tube are apt to vary to some extent, its position being dependent on slight variations of the adjacent organs, scarcely amounting to abnormalities.

The length of the œsophagus varies according to the stature of the individual, but in an adult male it generally measures from about twenty-four to twenty-six centimetres. The diameter of the tube varies at different levels, and, according to Sappey, it diminishes insensibly "from its upper extremity to the fourth dorsal vertebra, and increases again from that point in an almost insensible manner to its termination. It is therefore composed of two truncated cones united at the apex." [1]

Braune's sections [2] support this description in the main, but the measurements of the diameter of the gullet made by Mouton [3] from plaster-of-Paris casts give quite different results:

	mm.
Superior orifice of the œsophagus	14
At 1 ctm. below superior orifice	19
At 3½ " "	15
At 4 " "	15
At rather less than 7 ctm. from the superior orifice	14
At 11 ctm. from superior orifice	20
At 14 " "	17
At 15 " "	21
At 17 " "	20
At 21 " "	12
At 22 " "	12
At 25 " "	12
At 25½ " "	14

With the view of determining still more accurately the calibre of the gullet in its whole extent, I performed some experiments suggested by that of Mouton, but more elaborate and on more than one subject. The following were the methods adopted: In the first case the body was securely fixed, with the head downward, upon a board placed perpendicularly on the ground. The mouth and pharynx were then tightly stuffed with tow, so as to close the upper outlet of the food-tract, the stomach laid open, a ligature passed loosely round the cardiac opening, and the ends held outside the wound so that they could be tightened at once when

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mediately below. There is often some difficulty in counting the spinous processes, especially in the early stages of disease when there is but little emaciation, and it may therefore be well to remember that the œsophagus commences about an inch above the *vertebra prominens*, and terminates a little below the level of the inferior angle of the scapula.

[1] Traité d'Anatomie Descriptive, t. iv., p. 150. 3me édition, Paris, 1879.

[2] Atlas of Topographical Anatomy, translated by E. Bellamy. London, 1877. See plates vii., viii., ix., x., and xi.

[3] Du Calibre de l'Œsophage, Paris, 1874, p. 17.

required. The nozzle of a large anatomical syringe, previously charged with a mixture of plaster and water of about the consistence of cream, was next introduced into the lower orifice of the gullet, and the contents were injected with as little force as possible into the canal. When a sufficient quantity of the material had been used, the ligature was tightened round the cardiac aperture of the stomach, and the body was left undisturbed for nearly eighteen hours, so as to allow full time for the plaster to set firmly. On the next day the whole length of the gullet thus injected was removed from the body by a dissection conducted with the utmost care so as to avoid the least injury to the cast. The œsophageal wall was then carefully divided by a vertical incision carried along its whole length, when an accurate cast of the gullet was found to have been obtained.

Subject I.

A large-framed, muscular man, 6 ft. in height. The injection was made at the London Hospital in the early part of January, 1881. The length of the œsophagus was 27 ctm. The other measurements were as follows:

Point of Measurement.	Transverse Diameter. mm.	Antero-Posterior Diameter. mm.
Lower edge of cricoid.	25	14
1 ctm. below "	25	14
2 " "	23	18
3 " "	23	19
4 " "	24	17
5 " "	24	18
6 " "	21	19
7 " "	22	18
8 " "	22	18
9 " "	23	19
10 " "	24	18
11 " "	24	18
12 " "	24	20
13 " "	26	21
14 " "	27	23
15 " "	26	23
16 " "	27	22
17 " "	25	21
18 " "	24	20
19 " "	23	20
20 " "	25	20
21 " "	24	21
22 " "	24	23
23 " "	24	23
24 " "	27	22
25 " "	29	21
26 " "	31	22
27 " "	31	25

Although the subject experimented on was a large man, the dimensions of the œsophagus at different levels were so much greater than those given by Mouton that I thought it possible some artificial distention had been effected by a too forcible injection with the syringe. In the second case, therefore, the liquid plaster was poured down the gullet from the stomach with the aid of a filler.

Subject II.

A man, 5 ft. 4 in. in height. The œsophagus was injected with plaster-of-Paris on January 21, 1881, in the mortuary of the London Hospital. Death had taken place three days before, but the weather was very cold, and *rigor mortis* had not quite passed

away. The length of the œsophagus was 25½ ctm. The following were the other measurements:

Point of Measurement.	Transverse Diameter. mm.	Antero-Posterior Diameter. mm.
Lower edge of cricoid.	21	10
1 ctm. below "	19	15
2 " "	22	15
3 " "	22	14
4 " "	19	13
5 " "	18	15
6 " "	18	15
7 " "	19	13
8 " "	18	12
9 " "	19	14
10 " "	21	10
11 " "	23	11
12 " "	22	13
13 " "	23	17
14 " "	23	17
15 " "	25	17
16 " "	25	15
17 " "	24	18
18 " "	22	15
19 " "	21	14
20 " "	19	13
21 " "	16	11
22 " "	16	12
23 " "	17	21

In the second experiment the measurements are much smaller than the first, but the body was not nearly so large. Even in this instance, however, the standard of size is throughout very much greater than in Mouton's subject. The practical outcome of my experiments [1] is to show that the transverse diameter of the gullet is very considerably greater than the antero-posterior measurement.

When not distended in the act of swallowing, the mucosa, which is only very loosely connected with the submucous areolar tissue, is thrown into longitudinal folds, which project into the lumen of the canal, and at certain points fill it up altogether. It is only near its origin, however, and at about seven centimetres lower down, that this juxtaposition of the internal walls of the œsophagus closes the canal; at other levels it is probably always partially patent. As is shown by my experiments, the œsophagus is symmetrically flattened between the trachea and bodies of the vertebræ in the antero-posterior direction in the neck; and lower down, though its canal occasionally approximates to a circular form, it generally retains a kidney-shaped lumen.

In its cervical and thoracic portions the gullet comes into relation with important adjacent structures, which must be borne in mind in the diagnosis and treatment of its diseases. In its brief abdominal course its relations are of minor practical interest.

In the cervical region the gullet is in relation, *anteriorly*, with the membranous portion of the trachea, to which it is bound by loose areolar tissue. *Posteriorly*, it is separated from the vertebral column by the longi colli muscles. *Laterally*, it is in relation with the thyroid gland, especially its left lobe, with the common carotid arteries, and, more externally, with the pneumogastric nerves and internal jugular veins. In the angle between the trachea and œsophagus lie the two recurrent laryngeal nerves. Owing to its curve to the left, the œsophagus comes into more intimate relations with the left carotid artery than with the right, and for the same reason the left recurrent nerve is, at the root of the neck, almost in front of the tube.

In the thorax, the œsophagus is contained in the posterior mediastinum; it is in relation, *anteriorly*, from above downward with the following parts: viz., the trachea, the left carotid and subclavian arteries (near their origin from the left side of the

[1] It would be highly desirable that these experiments should be repeated on an extensive scale.

transverse portion of the arch of the aorta), the bifurcation of the trachea (opposite the third dorsal vertebra), the left bronchus (which crosses it obliquely), the bronchial glands; below this the posterior surface of the commencement of the arch of the aorta, and the posterior surface of the left auricle, or rather the corresponding part of the pericardium, are in near relation to the gullet. *Posteriorly*, the œsophagus is at first in close contact with the spine and longi colli muscles, but in its descent it becomes separated from these by loose connective tissue, by the right intercostal arteries, the vena azygos, and the thoracic duct as it passes obliquely upward from right to left. Just before the gullet leaves the thorax and on a level with the eighth dorsal vertebra, it comes into relation, posteriorly, with the descending aorta, the opening for which in the diaphragm is almost immediately behind that for the œsophagus. *Laterally*, the thoracic portion of the œsophagus is in contact with the pleuræ, with the vena azygos major on the right side, and on the left with the descending aorta. The pneumogastric nerves lie at first one on either side of the tube, but in their descent they pass, the left in front of it, and the right behind it.

The abdominal portion of the œsophagus is of very minor importance; it is covered by the peritoneum both anteriorly and posteriorly.

Like the rest of the alimentary tube, the œsophagus consists of three coats—mucous, submucous, and muscular. The mucous layer is of moderate thickness, and is mainly composed of loose connective tissue, which contains a large proportion of loose elastic fibres. Its surface is closely studded with delicate papillæ, which, together with the intervening depressions, are covered by a laminated pavement-epithelium. Between the mucous and submucous coats is a layer of plain muscular fibres, the muscularis mucosæ, which is imperfect in the upper part of the tube, but attains a considerable development inferiorly, where it forms a continuous investment, arranged in longitudinal folds. The submucous connective tissue is considerably thicker than the mucous coat, and so loosely attached to it as to allow very free movement of the latter, and to admit of its being arranged in longitudinal folds when the tube is in its natural state of contraction. The constituent bundles of the submucous, like those of the mucous coat, include a considerable number of elastic fibres, and form a stratum supporting the vessels and nerves. The muscular coat is composed of two layers of fibres, a circular or internal, and a longitudinal or external. The latter is the thicker, especially at the commencement of the tube, but it diminishes in thickness as it descends. It consists of three divisions—an anterior and two lateral. The former, which is by far the strongest of the three, is attached above to the ridge on the posterior surface of the cricoid cartilage by means of a triangular elastic ligament, while the lateral portions take origin from the elastic expansion of the palato-pharyngei muscles. In its course downward the longitudinal layer often derives a small muscular slip from the left bronchus—the broncho-œsophageus muscle, while similar additions to the circular layer are described as being occasionally obtained from the left lateral wall of the posterior mediastinum. The muscular coat of the œsophagus consists, in its upper fourth, mainly of striated fibres; in its second fourth, of about equal proportions of voluntary and involuntary muscle; while in the remainder of its course it is constituted almost entirely of unstriped fibres. The muscular coat is attached to the adjacent structures by a loose areolar investment, which contains a large proportion of elastic fibres.

The œsophagus contains a considerable number of mucous glands of the acinous, racemose, and compound tubular varieties.

These glands are lined with cylindrical epithelium, and are for the most part imbedded in the submucous connective tissue. They are less abundant in the human gullet than in that of many of the lower animals, and occur in greater numbers at the lower than the upper part of the tube. The vascular supply of the œsophagus is derived mainly from the thoracic aorta, inferior thyroid artery, and coronary branch of the cœliac axis; the vessels have mostly a longitudinal direction, and anastomose freely with one another. At the lower part of the œsophagus the veins communicate pretty freely with the coronary veins of the stomach, and are thus brought into relation with the portal system.

The lymphatics differ in their arrangement from those in other parts of the alimentary canal by forming only one layer, which is placed internal to the muscular coat. They communicate with neighboring glands, and near the root of the lungs terminate in the thoracic duct after having anastomosed with the pulmonary lymphatics.

The nerves are derived from the pneumogastric, recurrent laryngeal, and sympathetic, offshoots from which join each other in a complicated net-work (plexus gulæ), which encircles the œsophagus, lying for the most part between the longitudinal and circular layers of its muscular coat.

EXAMINATION OF THE GULLET.

The gullet can be examined during life by auscultation, by sounding, and by direct inspection with the œsophagoscope. Palpation also should not be neglected, for although the œsophagus itself cannot be felt, useful information may sometimes be obtained as to the condition of the neighboring parts. Thus deep-seated abscess of the neck, enlargement of the glands, fibroid thickening of the thyroid body, or the pulsation of an aneurism may be detected, while the negative evidence afforded by the absence of swelling or tenderness in the cervical region may in certain cases be important.

Auscultation of the Œsophagus.—This consists in listening either through the stethoscope or directly with the ear over the course of the gullet, while the patient swallows some fluid. The proposal of this method of examination is entirely due to Hamburger, and the short articles since published by myself,[1] Elsberg,[2] and Clifford Allbutt[3] are little more than epitomes of Hamburger's[4] essay. Œsophageal auscultation is easily carried out, but it requires considerable practice and much patience: practice, because it is requisite to get the ear well accustomed to the normal œsophageal sounds; patience, because in each case it is necessary to apply the stethoscope successively down the whole length of the œsophagus, and to listen attentively at each spot. Before attempting to apply the method in disease it is essential to become acquainted with the normal sounds produced in deglutition; and for this purpose repeated examinations should be made on healthy persons. The following is the best way of practising the art. The individual to be examined should be directed to take a mouthful of drink—water does very well for the purpose, but a thickened fluid, such as gruel or arrowroot, answers better. The stethoscope is then applied over some portion of the food-tract, the person is directed to swallow, and the sound produced in the act of deglutition carefully listened to. As the small portion of fluid, or, as it has been somewhat arbitrarily called, "the morsel," passes down the throat it produces various sounds, and conveys certain impressions to the mind of the listener. The proper interpretation of these sounds constitutes the art of œsophageal auscultation. If the stethoscope be applied to the side of the neck, on a level with the hyoid bone, and the person be directed to swallow a morsel, a loud, gurgling noise is heard, which may be called the "pharyngeal sound." The word "glou-glou" has been said to represent the pharyngeal sound; but in order to get an idea of it, "glouglou" should be pronounced in a loud whisper; and it must be admitted that in many healthy persons the sound does not bear much resemblance to this word. If instead of listening in the neck, the stethoscope be applied to the left side of one of the dorsal vertebræ, the true "œsophageal sound" becomes audible. The pharyngeal sound, which is due to the sudden passage of air and liquid into the pharyngeal cavity, is sometimes so loud, and so distinctly conveyed down the œsophagus, that it obscures the true œsophageal sound. In these cases it is better to let the patient take a continuous draught of water, as by this means the

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[1] Lancet, May 30, 1874.

[2] Auscultation of the Œsophagus. Philadelphia, 1875.

[3] British Med. Journ., 1875, vol. ii., p. 420.

[4] Klinik der Œsophaguskrankheiten, Erlangen, 1871. Hamburger's views, however, had been developed previously in a series of papers in the Oesterreich. Med. Jahrb., 1867, 1868, 1869.

intermingling of air and water is greatly diminished, and the true œsophageal sound may often be detected. The sound which is heard conveys the idea of the rapid passing downward of a "small spindle-shaped body of fluid consistence." The sound is sharp and sudden, and ceases abruptly. Hamburger describes it as being suggestive of an egg-shaped body, about an inch in length, and half an inch in breadth, the small end of the egg being above and the large end below. He is also of opinion that the shape of the morsel affords a strong indication as to the condition of the muscular walls of the œsophagus, the lower end of the morsel or egg-shaped body being blunted or truncated in proportion to the feebleness of the muscular action. These, however, are refinements which it is difficult to arrive at.

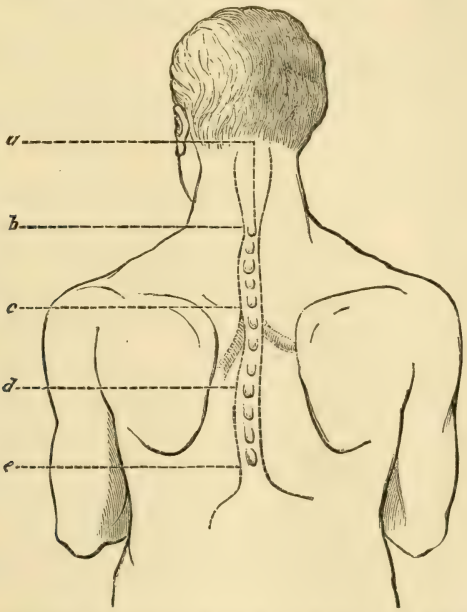

FIG. 1.—Diagram showing the Situation and Curves of the Œsophagus and its Relation to the Spinous Processes, Scapulæ, and Bifurcation of the Trachea. *a*, inferior curved line of occipital bone about five-eighths of an inch below the occipital protuberance, indicating the commencement of the pharynx; *b*, fifth cervical vertebra, at which spot the œsophagus commences (this spinous process can be easily recognized from its relative position to the vertebra prominens, usually the seventh); *c*, second dorsal vertebra; *d*, sixth dorsal spine; *e*, ninth dorsal spine. The upper third of the gullet therefore corresponds to the distance between *b* and *c*, the middle third to the distance between *c* and *d*, and the lower third to the distance between *d* and *e*. The position of the bifurcation of the bronchi from the trachea is seen to be in the middle third.

The principal points which have to be considered are—first, the character of the œsophageal sound; and, secondly, the quickness of the act of deglutition. In some cases the sound is very feeble, and occasionally altogether absent; sometimes, and this is often the case in organic strictures, a confused and continuous bubbling noise is heard, which lasts for several seconds; sometimes a grating sound may be perceived at the same time. The quickness of the act of deglutition is also of some importance, and can be determined by placing the hand on the hyoid bone while the stethoscope is applied over the œsophagus posteriorly; as the patient commences to swallow, the operator feels the hyoid bone rise, and can thus estimate the length of time which elapses before the morsel reaches that portion of the œsophagus which is being auscultated. The rapidity of the act varies

in different people in a state of health, and it can always be made to take place quite slowly. This will be at once apparent on directing a healthy man to continue for a few minutes swallowing some rather difficult substance, such as a mealy potato. Under ordinary circumstances the lapse of time between the entrance of the morsel into the gullet and its arrival opposite the stethoscope placed at the side of the eighth dorsal vetebra is so short that it cannot be determined ; but after swallowing several mouthfuls of potato without drink, two or three seconds elapse before the morsel arrives at the lower part of the œsophagus.

Regurgitation can also be perceived when from any cause the food cannot descend into the stomach. The mode in which this takes place sometimes enables us to distinguish between a spasmodic and an organic stricture ; for while in the latter case an appreciable time elapses before the food is forced upward, in spasmodic stricture the regurgitation is instantaneous. According to Hamburger, when the œsophagus is pressed upon by a tumor in the posterior mediastinum, the sound may be heard more distinctly on the right side of the vertebræ than on the left.

Sounding.—This method of exploration is carried out with the aid of *bougies,* and is employed for the purpose of determining the calibre of the gullet. It should be borne in mind, however, that much harm is often done by the introduction of these instruments. They should, therefore, never be used unless other means of investigation fail to give the desired information. Two kinds of bougies are employed under different circumstances, viz., those made of gum-elastic, and those in which there is a slender whalebone stem, terminating in an olive-shaped ivory knob. Ordinary gum-elastic bougies are cylindrical[1] in form throughout the greater part of their length, but the distal end is more or less conical. From the experiments, however, already detailed (pages 3 and 4), as well as from the appearance in frozen sections,[2] it is clear that the sectional outline of the gullet is oval or kidney-shaped, the diameter from side to side being greater than from before backward. I have, therefore, arrived at the conclusion that bougies somewhat flattened antero-posteriorly would most easily adapt themselves to the lumen of the tube through which they are meant to be passed, and this view has been confirmed by experience. Thirteen sizes are made, the measure of each one being based on the number of millimetres in the transverse, *i.e.*, their long diameter. The sizes are reckoned from No. 3 to No. 15. Thus, No. 3 measures 3 mm. from side to side, No. 4, 4 mm., and so on throughout the scale. Nos. 1 and 2 are not made, as they are too small to be of any use.

The ivory-knobbed bougies are sometimes useful when the obstruction is of a spasmodic character, the spasm occasionally yielding to a knob while resisting a cylindrical body. The knob at the end of the whalebone stem resembles an olive in shape, the small end being directed downward. The same whalebone rod can be used for several knobs of various sizes, as they are made to unscrew. These instruments have not hitherto been made according to any scale, and I very seldom use them, on account of the risk there always is of the ivory knob becoming separated from the stem. Although in the ordinary course the little point would pass into the stomach

[1] In some cases, however, tapering and the so-called "radish-shaped" instruments may be useful. The tapering bougie is small at the distal end, and gradually increases in size for about three or four inches till the maximum diameter is attained ; and the radish-shaped instrument is slender at its further extremity, then becomes somewhat suddenly greatly enlarged, again returning to the smaller dimensions.

[2] Braune : Op. cit., pl. vii., viii., ix., x., and xi.

and do no harm, there is some danger of its being vomited or hawked upward and finding its way into the air-passages. It is obvious that the danger is much increased where there is a stricture of the gullet, as under such circumstances the knob cannot pass downward, and it will most likely be thrown violently upward by sudden spasm of the muscular walls of the œsophagus.

When a gum-elastic bougie has to be passed it should be warmed and then dipped into water or glycerine (not oil, as that is often very disagreeable to the patient), and then slightly bent at about an inch from its extremity, so that when introduced into the throat the point of the bougie presses slightly by its own elasticity against the posterior wall of the pharynx, and is thus unlikely to enter the larynx. The patient should sit with his neck stretched out and his head thrown slightly back, while the operator standing in front depresses the tongue with the forefinger of his left hand, and directs the point of the instrument downward in a slanting direction against the middle of the posterior wall of the pharynx at its lowest part. In introducing the bougie, about four inches of its length should extend beyond the hand, and it should be pushed slowly and gently down the throat. When the instrument is judged to have entered the œsophagus, it is a good plan to tell the patient to bend his head a little forward, and to perform the act of swallowing. Should any obstruction to its course be encountered, the instrument should be withdrawn and again carefully passed into the gullet.

If it be again arrested at the same point and the employment of *very gentle pressure* and manipulation fail to pass it beyond the obstacle, it should be altogether withdrawn, and a bougie several sizes smaller introduced. Proceeding in the same manner and with like precaution, the operator should, if the attempt does not cause any great discomfort or irritation, try a third or fourth instrument, as the case may be, until he either penetrates the stricture or concludes that it is impermeable. Should the bougie be found to pass beyond the point at which the first instrument was arrested, it should be pushed steadily downward until it reaches the stomach, while the character of the surface over which it glides, the direction in which it goes, the distance traversed, and the contractile power of the œsophagus at different levels should be carefully noted. It is necessary to take the precaution of passing the instrument quite down to the stomach, as there sometimes exists a second stricture below the first. On withdrawing the bougie, the distance from the patient's teeth to its extremity should always be measured. It should be remembered, however, that the distance from the incisor teeth to the orifice of the œsophagus varies from 15½ to 17 ctm., and in estimating the situation of an obstruction this length must be always deducted from the length of the bougie passed into the body. If a good-sized

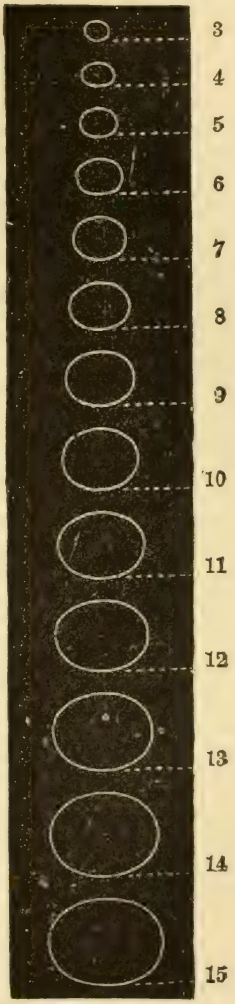

FIG. 2.—The Author's Scale for Œsophageal Bougies.

bougie can be passed without encountering any obstacle, a larger one may be employed at the next visit if any symptoms of obstruction continue. If, however, a No. 15 (see scale, p. 9) can be passed through the whole length of the canal, it may be concluded that there is no mechanical obstruction—*i.e.*, no organic stricture. An instrument has been invented by Dr. Gaston Sainte-Marie,[1] by means of which it is proposed to measure the calibre of the gullet throughout its entire extent, or at any given point. It consists of a hollow sound, at the lower end of which is a small olive-shaped bag made of india-rubber, so that its capacity is diminished by very slight pressure. Into the upper extremity of the sound is fitted a graduated glass tube, about ten centimetres long, provided at its upper part with a stopcock and a metallic funnel. By this means water, or some colored liquid, can be poured into the instrument, thus distending the bag at the other end to the fullest extent. It is obvious that any pressure on the walls of the bag will cause the fluid to rise above its original level in the glass tube, and the greater the pressure the higher will the contained fluid be forced. I am not aware that this instrument has ever been tried in actual practice, and it is evident that it would be difficult to use in such a way as to obtain any trustworthy results.

Œsophagoscopy.—This method consists in the visual examination of the interior of the gullet by means of suitable instruments. These must necessarily be in the form of tubes, and their use is always likely to be attended with considerable difficulty; for, unlike the larynx and trachea, which are nearly always open to inspection, the orifice of the gullet is closed, and lower down the walls of the canal are usually in more or less close apposition. Further difficulty arises from the spasmodic contraction, so easily set up, of the muscular tunic of the œsophagus, and also from the pharyngeal irritation which almost unavoidably occurs in introducing instruments.

The older surgeons do not appear to have endeavored to overcome these difficulties, and the first attempt to examine the gullet during life would seem to have been made by Semeleder and Stoerk in 1866.[2] This experiment, however, yielded only negative results. The instrument employed appears to have consisted of a forceps with spoon-shaped blades. The idea of the instrument originated with Semeleder, who offered himself to Stoerk for experiment. After the introduction of the instrument, the laryngeal mirror was placed in the ordinary position, but it was at once found that the view was obstructed by a kind of figure-of-eight projection of the mucous membrane between each blade of the forceps.[3]

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[1] Des différents modes d'exploration de l'Œsophage. Paris, 1875, p. 21.

[2] Private letter from Professor Stoerk, November 13, 1880. Dr. Stoerk has since published an account of this experiment in the article in which his more recent invention is described (Wien. klin. Wochenschrift, No. 8, February, 1881).

[3] In 1868 Bevan (Lancet, vol. i., April, 1868) published a description of various instruments for examining the pharynx, larynx, and posterior nares, fitted to a lamp, on the principle of the endoscope. In this paper there is no detailed description of the œsophagoscope, but merely a few lines describing the figure which illustrates it. As far as I can make out from this drawing, the œsophagoscope appears to be a straight tube, four inches long by three-quarters of an inch in diameter, which has attached to its upper extremity, by means of a wire on each side, a ring slightly larger in diameter and about one inch in length. This ring is placed at an angle of about forty-five degrees to the tube, and to it the pharyngoscopic tube of the endoscope was, to use the words of the inventor, "very easily applied." It is not stated that any mirror was used, but as a reflector is seen in the drawing of the pharyngoscope it was probably employed for inspecting the gullet. A perusal of Bevan's paper will convince any reader that the experiments were the results of work in the library rather than in the wards of a hospital; and, in fact, that the instrument is of no practical value.

Two years afterward the late Dr. Waldenburg[1] invented an œsophagoscope. This instrument was a gum-elastic tube, 8 ctm. in length. It was slightly conical in shape, the diameter above being 1½ ctm., and below, 1 ctm. It was connected to the extremity of a two-pronged fork, 14 ctm. in length, in such a way that considerable movement was permitted between the fork and the tube. After the introduction of the instrument it was held with the left hand, and the tongue being slightly pressed down, the laryngeal mirror was put into the mouth. In the case in which Dr. Waldenburg used the instrument there was a pouch at the upper part of the gullet on the left side, and he was able to keep the instrument *in situ* for ten or fifteen seconds, and to see that the mucous membrane of the œsophagus was not ulcerated or in any way diseased. On introducing the speculum into the diverticulum itself, that cavity was seen to contain a small quantity of food. Afterward Waldenburg had an instrument constructed of metal instead of gum-elastic, consisting of two tubes arranged telescopically, each tube being 6 ctm. in length, one playing on the other by means of a slot. Waldenburg's instrument was exhibited and used on a patient by Professor Stoerk, before the Society of Physicians of Vienna.[2]

Subsequently Stoerk employed an instrument resembling Waldenburg's, but consisting of three tubes. In February, 1881, Professor Stoerk[3] described a new œsophagoscope, which consists of a lobster-jointed tube, covered with india-rubber, with a small mirror attached to its upper extremity, and with a handle, consisting of a two-pronged fork like that of Waldenburg. This tube is provided with a pilot, or director, consisting of a piece of elastic tubing, terminating in a small bag which projects beyond the end of the œsophagoscope, the diameter of the bag being a little larger than that of the tube. The ball being inflated, the instrument is passed into the gullet, when the air is allowed to escape, and the pilot withdrawn.

My own attempts to examine the gullet with an œsophagoscope were first made in February, 1880. From the following description it will be seen that the instrument which I have introduced [4] is altogether different from those hitherto employed. It consists of two parts—a stem and a skeleton tube. The stem is made up of a handle and a shank, between which there is a hinge. The skeleton tube is only formed when the instrument has been introduced into the gullet; before that it consists of two flattened wires placed anteriorly and posteriorly, connected above and below, and at certain intervals between the extremities, by rings. When the rings lie in the vertical position the wires are separated from each other only by the thickness of the rings, but when the latter are thrown into the horizontal position the two wires become separated, and, with the rings, constitute a kind of skeleton speculum.[5] At the top of the back wire there is a slot into which the stem of a laryngeal mirror is fitted. In

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[1] Berlin. klin. Wochenschrift, No. 48, November 28, 1870.

[2] Letter before quoted. The professor does not recollect the exact date of the exhibition of the patient, but no doubt an account of it would be found in the Transactions of the Imperial-Royal Society of Physicians of Vienna in or about the year 1871.

[3] Loc. cit.

[4] This, as well as most of my other instruments described in this work, were made for me by Messrs. Mayer & Meltzer, Great Portland Street.

[5] In the earlier instrument which I employed there were a great number of rings, and the speculum was opened and closed by means of a movable slide on the upper part of the shank, the handle remaining fixed.

the upper figure (A) of the annexed cut it will be seen that the handle and shank are almost in a line—a position which greatly facilitates the introduction of the instrument. When the vertical portion has been passed down the œsophagus, the operator, holding the handle in his hand, but leaving the index-finger free, presses with the latter on the upper part of the shank near the handle. The result of this is to turn the rings from the vertical to the horizontal position, and thus to open the speculum and expand the gullet. With the view of causing as little irritation as possible, the operator should, before withdrawing the instrument, close the speculum by pressing the under part of the shank (near the handle) with his thumb, at the same time raising the handle.

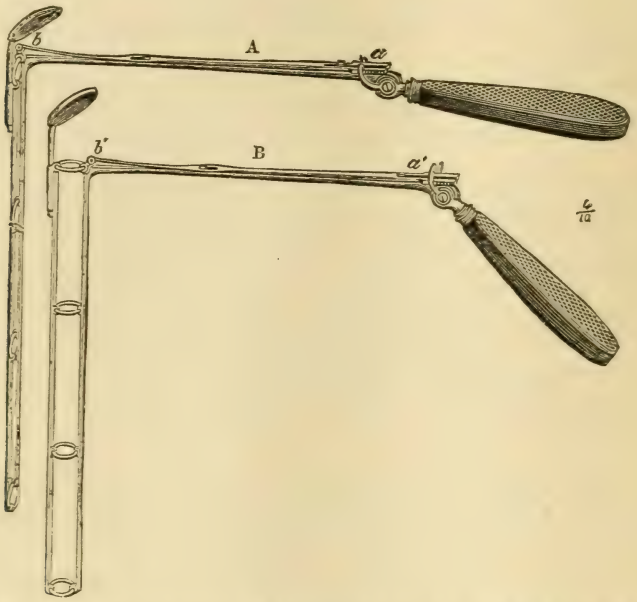

FIG. 3.—The Author's Œsophagoscope. The instrument is seen in A ready for introduction, the handle being almost in the same line as the stem. When the instrument has been passed down the gullet, as seen in B the handle is depressed, and the moving rod *a* being thus drawn back, the lever *b* elevates the small ring with which it is connected, and raises the mirror to its proper place while it expands the skeleton tube, and thus dilates the œsophagus.

In November, 1880, I had attempted to use the instrument on fifty patients, and I had succeeded thirty-seven times. Subsequently I have employed it from time to time, whenever a suitable case has presented itself.

Endeavors have recently been made to examine the interior of the gullet with the help of the electric light, and Mikulicz[1] claims to have made some very important clinical observations by this method.

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[1] Wien. Med. Presse, 1881, Nos. 45–52. Mikulicz, who has lately been working with the assistance of Leiter, of Vienna, appears to have improved the apparatus of that instrument-maker (see vol. i., p. 368, Note 1). When, however, Leiter's earlier specula were exhibited in Paris, Dr. Ranse (Gazette Médicale, No. 25, p. 331, 1880) maintained that the invention was little more than a reproduction of Trouvé's "polyscope," without some of the advantages of that instrument.

ŒSOPHAGEAL INSTRUMENTS.

FIG. 4.—Œsophageal Injector.

Brushes.—These are of little use for applying remedies to the interior of the œsophagus, as the medicament is to a great extent lost before it reaches the affected part; but they are sometimes of service when the disease is situated quite at the upper part. The kind of brush which should be employed for this purpose is one similar to those used for the larynx, but about two inches longer than No. 1 brush.

Injectors.—For applying solutions to the interior of the gullet the "œsophageal injector" is the most useful instrument. It consists of a long leaden tube, from sixty to seventy-five centimetres in length, and two to three millimetres in diameter, to which is welded a bulbous terminal portion, made of silver. The silver extremity is perforated by a number of fine holes, and the fluid is injected by means of a minute pear-shaped india-rubber ball. The tube is passed down to the desired spot; the nozzle of the elastic ball is then introduced into the upper end of the pipe, which is slightly funnel-shaped, and the fluid injected by pressing the ball.

The Œsophageal Electrode.—This instrument is similar to the laryngeal electrode (vol. i., p. 186), but should be about twenty-six centimetres in length below the handle, and pliant in the stem, so that it may more readily adapt itself to the natural curves of the gullet.

The Œsophageal Resonator.—For the discovery of small foreign bodies, such as pins or other metallic substances, pieces of bone, etc., an ingenious instrument has been devised by M. Duplay.[1] It consists of a stem of very flexible steel, about eighteen inches long, covered throughout with india-rubber; to the lower end of this is screwed a hollow olive-shaped ball of ivory, which may be of various sizes, while to the upper end of this is attached a "drum" of copper, about six inches long, to serve as a sounding-box. To the proximal end of the drum is fixed an india-rubber tube, provided with an ivory ear-piece. The instrument is passed into the gullet in the ordinary way, and the ear-piece placed in the ear. Very slight scratching sounds, such as would be produced by the olive-shaped ivory ball coming in contact with a foreign body, can then be readily distinguished. If the stem of the instrument be properly graduated the situation of the foreign substance can also be ascertained with tolerable accuracy.

FIG 5.—Duplay's Œsophageal Resonator. *a*, india-rubber tube; *b*, sounding-box of copper; *c*, metallic stem covered with india-rubber; *x*, olive-shaped ivory ball; *y*, junction of stem to sounding-box; *z*, ivory ear-piece.

It should be added that the instrument can be used as a

[1] Bull. de la Soc. de Chir. de Paris, October 7, 1874.

common sound by detaching the sounding-box and ear-tube from its upper extremity and screwing on a metallic ring, to serve as a handle.

Œsophageal Forceps.—For the removal of foreign bodies from the gullet, a pair of long forceps may suffice, or specially-devised instruments, such as the parasol bougie, or the so-called "coin-catcher," may be required. The forceps should be about thirteen inches long, the two blades crossing each other at a point equidistant from the extremities. The curve should be very slight (Fig. 6). Forceps with a flexible stem may also be useful in extracting foreign bodies from the gullet, or Burge's forceps, of the same shape as that used for the nose, may be employed. The mode in which this instrument acts will be understood by referring to the woodcut representing the Axial Nasal Forceps (see Nasal Instruments).

FIG. 6.—The Œsophageal Forceps.

The Parasol Probang.—This instrument consists of a whalebone rod, terminating in a twist of stiff horse-hair, which is capped at the extremity by a small metal knob or sponge. The whalebone rod is enclosed in an outer gum-elastic tube. The instrument should be passed in the same manner as the ordinary bougie, if possible, beyond the supposed position of the foreign body. Holding the gum-elastic tube in the left hand, the surgeon should then slightly draw up the whalebone rod with the right hand, the horse-hair portion being thus made to expand like a parasol. In withdrawing the instrument with both hands, the whole interior of the œsophagus is thus swept out, and any small foreign body is almost certain to be entangled in the meshes of the expanded web of horse-hair. If the resistance is so great as to cause risk of injury to the soft structures, the whalebone rod controlling the parasol should be released and the instrument withdrawn with its expansile portion closed. In the probang, as commonly made, the knob is about the size of a bullet, but it should not be larger than a good-sized pea—the object of the instrument not being to push the foreign body down, but to pull it up.

FIG. 7.—The Parasol Probang. A, the instrument ready for use with the catgut parasol closed; B, the instrument after it has been passed down the throat with the parasol open.

Coin-catchers.—There are two kinds of coin-catchers. One (Fig. 8, A) consists of a small whalebone rod, about fifteen inches long, with a flexible

metal plate one inch and a half in length securely fixed to its lower part. The distal extremity of the metallic plate is attached by means of a cross rivet to the interior of a small hollow metal cone about its middle. Free play is thus allowed to the cone on either side of the stem, so that a little cradle is formed, the concavity of which looks upward. The surfaces of the cone, corresponding to the metallic part of the stem, are fenestrated, while the rim of the cradle is slightly notched at each side. Another form of coin-catcher (Fig. 8, B), which is perhaps more commonly employed, consists, like the above, of a whalebone rod, to which a short plate of flexible metal is attached. This plate, however, ends in a small metal ring, to the lower part of the circumference of which another ring of similar size is securely welded so as to form an angle of about 45° with its fellow.

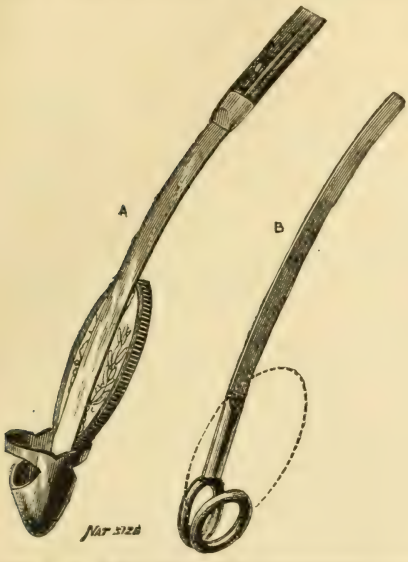

FIG. 8.—A, Grāfe's coin-catcher, holding a coin: B, ring coin-catcher.

Both these instruments easily slip down at the side of a small foreign body, but on being withdrawn, a piece of money or any other object lying loose in the canal, such as a fruit-stone, or a set of artificial teeth, is very likely to be caught. Even when such a body has passed into the *stomach* it may sometimes be fished up! A remarkable case of the kind has been recorded [1] in which Mr. L. S. Little, formerly of the London Hospital, succeeded in removing a set of false teeth with a gold plate from the stomach of a woman who had swallowed them during an epileptic fit.

The Sponge-Probang.—This instrument is merely a gum-elastic bougie, tipped at its distal end with a piece of sponge securely tied on. It is used for pushing down into the stomach any substance of the nature of food which has stuck in the gullet, or a foreign body of any kind which cannot be extracted.

The Œsophagotome.—For the internal division of strictures of the gullet, various instruments have been

FIG. 9.—The Œsophagotome with the Knife Concealed. *a*, the protruded knife; *a'*, the concealed knife; *b'*, the button which acts on the spring; *b*, the button pressed down; *c*, sliding tube containing the spring.

[1] Royal Med. and Chir. Soc. Proc., February 8, 1870; Lancet, February 19, 1870, p. 268.

invented, particularly by French surgeons. I have devised a very simple instrument (Fig. 9) which has been successfully used, both by myself [1] and by Dr. Roe,[2] of Rochester, N. Y. It consists of a gum-elastic bougie about fifteen inches long, terminating in a small metal cap about one inch in length and of slightly larger calibre than the rest of the instrument. Through the interior of the bougie passes a wire, the lower end of which is attached to a small cutting blade, while its upper extremity is connected with a spiral spring. By pressing a metallic button at the top of the bougie, the knife is projected through a slit in one side of the metal cap. A little notch in the edge of the button corresponding to the slit guides the operator as to the position of the knife. Instruments with two blades cutting sideways have been used by Trélat [3] and Dolbeau [4] for the division of œsophageal strictures, but a single blade seems to me preferable, and the close proximity of the internal and common carotid arteries at the upper part of the gullet on both sides and of the aorta lower down on the left side, makes it desirable that the knife should cut only in a backward direction.

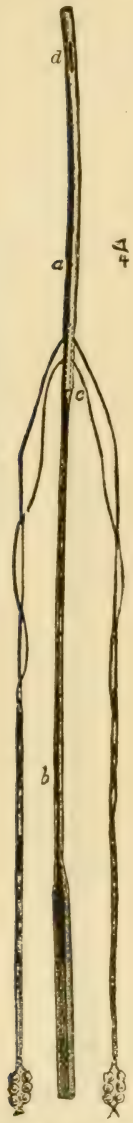

FIG. 10.—Permanent Œsophageal Tube. *a*, gum-elastic catheter; *b*, whalebone pilot rod; *c*, strings; *d*, side opening in tube.

The Permanent Œsophageal Tube.—This instrument (Fig. 10), which I have used for several years with considerable success, consists of two parts; the lower portion being a fine gum-elastic catheter, of No. 6 size (English), about six inches in length. To the upper end of this tube are attached two strings, about one foot long, and loaded at their free extremity with small shot. The upper part of the instrument is a solid stem, made of vulcanite or whalebone, the lower extremity of which is pointed so as to fit loosely for about an inch into the upper orifice of the catheter. The instrument should be passed down the gullet in the manner recommended in describing the use of solid bougies, the strings being held close to the upper part of the whalebone guide, so as to keep its point inside the catheter. When the latter has been passed through the strictured portion of the canal, the solid stem or handle should be withdrawn, care being taken to release the strings so that the catheter may not be pulled out at the same time. The strings should then be fastened round the patient's ears or the back of his head. The catheter is thus left in the narrowed part of the gullet, and liquids can be swallowed with comparative ease. The great advantage of the instrument is, that it causes no pharyngeal irritation. It can generally be allowed to remain *in situ* for five or six days, when it should be removed by means of the strings, as the gum-elastic is likely to be decomposed, or the tube itself clogged up. Another instrument may then be substituted for it in the same manner. It is to be remarked that I only em-

[1] For details of my case see Cicatricial Stricture of the Gullet. [2] Ibid.
[3] Bull. Thérap., Mars 30, 1870, t. lxxviii., p. 252.
[4] Soc. de Chir. de Paris, Mars 16, 1870.

ploy this instrument where absolute aphagia exists, and that generally the catheter has to be pushed through the stricture with force.

Dr. Krishaber,[1] of Paris, has lately recommended that in cases of advanced stricture of the gullet a common gum-elastic catheter of suitable size should be passed into the patient's stomach through one of his nostrils,[2] and left permanently *in situ*. The instrument is fixed in position by means of a strong needle transfixing the catheter near its mouth, and having attached to its ends two strings, which are fastened to the brow with strips of plaster. A plug should be left in the upper end of the tube, except when the patient is being fed. By means of this instrument Dr. Krishaber has been successful in prolonging for several months the lives of patients who must otherwise inevitably have died of starvation. In one case, indeed, life was maintained in this manner for the greater part of a year (305 days). Mr. Durham[3] has successfully tried the same plan, but prefers passing the catheter through the mouth, as being less disagreeable to the patient.

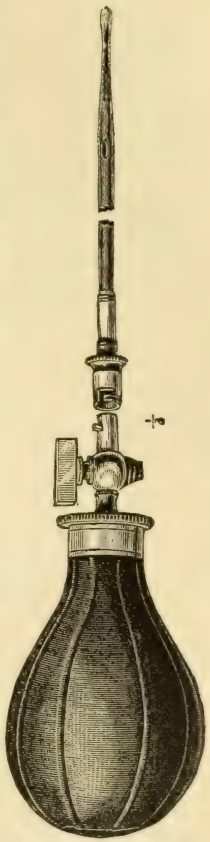

Fig. 11.—Œsophageal Feeding-tube.

The Œsophageal Feeding-tube.—This instrument is very useful when there is a fistulous communication between the gullet and the air-passage, which allows the ingesta to find their way into the larynx or trachea. The instrument consists of three portions: first, a gum-elastic tube of the size of a No. 8 English catheter, terminating at one end in a slightly bulbous extremity perforated laterally by two rather large holes, and at the other in a metal ring and bayonet joint; secondly, a pear-shaped india-rubber bottle; thirdly, a connecting portion of metal tubing provided with a screw and a tap. The mode of using this instrument is as follows: The connecting portion is first unscrewed and the nutritive fluid poured into the bottle, when the metal tubing is again screwed on, and the tap closed. The practitioner now introduces the gum-elastic tube into the œsophagus, and an assistant at once hands him the feeding-bottle, which he quickly adjusts to the bayonet joint, and turning the tap, injects the fluids. As there is generally great irritability of the throat in such cases, the success of the operation largely depends on the quickness with which it can be performed. In

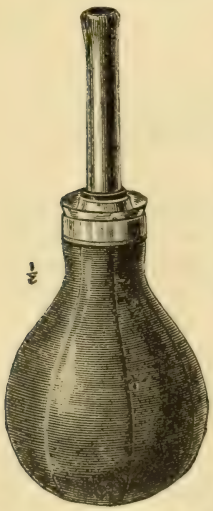

Fig. 12.—The Rectal Feeding-bottle.

[1] Trans. Intern. Med. Congress, London, 1881, vol. ii., p. 392 et seq.

[2] In insane persons, or others who perversely refuse food, this method of administering sustenance is most efficacious, as any difficulty in opening the patient's mouth is thereby avoided, and he is unable to apply his teeth to the instrument, or to the fingers of the operator.

[3] Proc. Clin. Soc. Lond., November 11, 1881, reported in Lancet, November 19, 1881, vol. ii., p. 873.

cases of emergency, where this instrument is not at hand, a common catheter and an ordinary enema-bottle can be used, but the tap and bayonet joint greatly facilitate the operation of feeding.

The Rectal Feeding-bottle.—It so often happens that in diseases of the throat feeding *per rectum* becomes necessary, that this seems to be the appropriate place for describing the instrument which will be found most serviceable for the purpose. The ordinary liquid injections, such as beef-tea, eggs, milk, and brandy, have proved so unsatisfactory in my hands that I have for a long time employed the panada first recommended by Leube (see Appendix, vol. i., p. 425). As this panada, however, will not pass through an ordinary enema-pipe, it is necessary that the elastic bottle should be furnished with a short vulcanite tube, having a bore of not less than half an inch. The difficulty of drawing up the nutritive fluid through the tube by the common vacuum process makes it requisite that the vulcanite nozzle should be capable of being easily unscrewed, in order that the bottle may be filled with a spoon or funnel.

DISEASES OF THE GULLET.

ACUTE ŒSOPHAGITIS.

Latin Eq.—Œsophagitis acuta.
French Eq.—Œsophagite aigüe.
German Eq.—Acute Entzündung der Speiseröhre.
Italian Eq.—Esofagite acuta.

Definition.—Acute idiopathic inflammation of the mucous membrane of the œsophagus, giving rise to extreme odynphagia, and often to aphagia. The disease is attended with some danger, but generally ends in resolution, and only in extremely rare cases terminates in ulcer, abscess, or gangrene.

History.—Among the ancient physicians Galen[1] alone appears to have recognized this disease. After referring to difficulty of swallowing caused by tumors and paralysis, he observes that when the œsophagus is affected by inflammation the condition of the part itself acts as a hindrance to the passage of food; deglutition, moreover, being accompanied by excruciating pain. In 1722 Boehm[2] called attention to the complaint, especially dwelling on the pain and heat which "reach even down to the stomach, accompanied by hiccough and a constant flow of serum from the mouth." In 1745 Van Swieten[3] gave a short account of the affection, obviously based more upon literary research than experience. Honkoop[4] published a thesis on inflammation of the gullet in 1774, and in 1785 Bleuland[5] described the disease in his short treatise on the œsophagus. Bleuland's remarks are entitled to special weight, inasmuch as he had himself suffered from a violent attack of the disorder, whereas the previous accounts of this rare affection appear to be entirely founded on Galen's description, which is admirably accurate so far as it goes, but necessarily incomplete. Besides his own attack,

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[1] De locorum affect. notitiâ, lib. v., cap. iv.

[2] Dissertatio de morbis œsophagi. Halæ, 1772. This was a thesis presented by Boehm for the doctor's degree, under the academical presidency of the celebrated Hofmann, to whom the work has generally been ascribed by subsequent writers.

[3] Comment. in H. Boerhaave aphorismos, Lugduni Batavorum, 1745, t. ii., p. 662, § 804.

[4] Diss. de morbo œsophagi inflammatorio. Lugduni Batavorum, 1774.

[5] Obs. anat. med. de sanâ et morbosâ œsophagi structurâ. Leidæ, 1785.

Bleuland states that he was acquainted with the details of four other cases of the complaint which had occurred in the practice of his master Van Doeveren. A good description of the disease was given in 1792 by John Peter Frank,[1] who first proposed to designate it by the name "œsophagitis." Some years later the pathology of inflammation of the gullet as it is met with in new-born children was studied with great zeal and ability by Billard,[2] who in 1828 published a number of very interesting cases of the affection, together with some important observations as to its etiology. In 1829 Mondière[3] who, like Bleuland, had had an opportunity of observing the disorder in his own person, chose it as the subject of his inaugural thesis, and described the symptoms and course of the affection very accurately. He founded his pathology, however, entirely on Billard's description of the appearances in fatal cases occurring in new-born infants—cases which differ widely as to their etiology, nature, and course, and cannot be accepted as affording a satisfactory basis for the pathology of idiopathic œsophagitis in adults. In 1831 Mondière[4] returned to the subject, treating it with fuller learning, but with no further novelty. In 1835 Graves[5] made some remarks on œsophagitis in commenting on a case of the disease which he had been called upon to treat. The subject has received additional illustration from Hamburger,[6] Padova,[7] and Laboulbène.[8]

Etiology.—This affection is certainly very rare, but not so rare as the exceedingly brief description, and frequent complete omission of the subject from the ordinary text-books of surgery and medicine, would lead the student to imagine. It is highly probable that the very insufficient way in which the subject has been handled is the cause of the complaint often not being recognized, and I venture to hope that in future the true nature of some cases will be appreciated which might otherwise have been overlooked.

There are not sufficient examples on record to enable us to arrive with any degree of certainty at the cause of this affection in adults. Occasionally it appears to originate in the pharynx and to spread downward, and in some epidemics of "angina" this tendency has been very remarkable ;[9] in one instance the disorder seems to have extended upward in the course of a general inflammation of the intestinal tract, but the disease in this case was complicated by ague.[10] In an example related by Laboulbène,[11]

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[1] De curandis hominum morbis, lib. ii., pp. 104, 105. Mannhemii Tubingæ, Viennæ. 1792–1821.

[2] Maladies des Enfants nouveau-nés. Paris, 1828. See also third edition, 1837.

[3] Sur l'Inflammation de l'Œsophage. Thèse de Paris, 1829. Mondière afterward studied diseases of the gullet in general with much assiduity, and collected a large amount of material scattered through various writings. Although his laborious compilation shows more industry than discrimination, his essays are of very considerable value even at the present day, for, in spite of his somewhat unwieldy erudition, he was a shrewd observer. His writings have been the source from which much of the literature of œsophageal disease has since been drawn. Thus in Velpeau's article (Œsophage—Dictionnaire en Trente Volumes), in Follin's essay Sur les Rétrécissements de l'Œsophage), in Copland's Dictionary, and lastly in the highly creditable work of Knott on the Pathology of the Œsophagus, Dublin, 1878 (published while the author was still *in statu pupillari*), we find the cases of Roche, Bourguet, Broussais, Paletta, and several others collected by Mondière, constantly referred to, with very few original illustrations of the disease. On the other hand, but scanty justice has been done to Billard, whose work in this field was the fruit of careful independent investigation.

[4] Arch. Gén. de Méd., 1831, t. xxv., p. 358.

[5] Clinical Lectures, Dublin, 1848, vol. ii., p. 199, second edition. Previously reported in Lond. Med. and Surg. Journ., No. 172.

[6] Medicin. Jahrb., Bd. xviii. and xix., December 8 and 22, 1869.

[7] Annali Universali di Medicina e Chirurgia, Milano, Aprile, 1875, vol. ccxxxii., pp. 17–24.

[8] Nouveaux Eléments d'Anatomie Pathologique, Paris, 1879, p. 84.

[9] Annales de Montpellier, t. iv., p. 87.

[10] Padova: Annali Univ. di Med. Milano, Aprile, 1875.

[11] Nouveaux Eléments d'Anatomie Pathologique, Paris, 1879, p. 84.

the drinking of cold water was the only assignable cause. Mondière [1] reports one case in which the disease followed an attack of inflammation of the stomach, but the actual occurrence of the œsophageal mischief was attributed to a dose of castor-oil. Another instance is on record [2] where the onset of the complaint was attributed to violent muscular exertion in a fit of passion, but the nature of the case was somewhat obscure, and by some physicians it was thought that there was partial rupture of the muscular fibres of the œsophagus. Out of five cases which I have myself met with, in one the disease was caused by direct application of cold to the lining membrane of the gullet through eating ices ; in a second the supposed cause was the abuse of alcohol ; in a third the attack followed accidental immersion in a river ; while in the remaining two the malady occurred in patients who were subject to rheumatism.

Symptoms.—In adults the most marked symptom is odynphagia, the pain on attempting to swallow being often of a most excruciatingly burning or tearing character, and sometimes reaching such a degree of intensity that the patient is obliged to desist altogether from taking food or even drink. Even when he is not swallowing there is often a dull aching sensation in the pharynx behind the jugular fossa or the ensiform cartilage. Pressure made by the surgeon on the larynx or trachea from before backward intensifies this uncomfortable feeling. The patient generally complains of stiffness of the neck, and holds his head in one position, the least movement aggravating his suffering.

He is usually unwilling to speak on account of the pain caused by any action of the laryngeal muscles. There is not unfrequently a sensation as of a foreign body in the throat. Padova's [3] patient described a feeling like a *knot* in the throat, while in Graves' [4] case the sensation was that of a *ring,* beyond which the food could not pass. The patient almost always experiences great thirst, and being unable to get relief by drinking, he is much tormented by this distressing symptom. The earlier writers lay great stress on hiccough as an unfailing accompaniment of this malady, but it has not been present in any of the cases that have come under my notice. When the inflammation is slight, it may give rise to spasm of the œsophagus, a condition which will be hereafter considered. If the mischief extend to the ary-epiglottic folds, dyspnœa may supervene. In adults the constant exspuition of frothy or glairy mucus is very characteristic. In all my five cases this symptom was present.

The general symptoms are those of irritative fever, but not of a high degree ; in no case that I have met with has the temperature been above 102° F., and the pulse has not exceeded 130. Occasionally, however, there is some delirium. Bleuland [5] himself suffered from this complication, and it was present in one of my cases.

It is probable that in some instances the inflammation becomes really purulent in character, but this has not occurred in my own experience, and I have not met with a single recorded example of idiopathic origin in which it was observed. Should the inflammation, however, result in the formation of an abscess, rigors occur, and the local symptoms generally become intensified for the time. When the abscess bursts, blood and pus are expectorated, and a rapid recovery usually takes place. When the disease is confined to a particular portion of the gullet, its situation can be ascertained by auscultation, the œsophageal sound abruptly terminating immediately below the point of inflammation.

[1] Arch. Gén. de Méd. t. xxiv. [2] Ibid. [3] Loc. cit. [4] Loc. cit. [5] Loc. cit.

When once a favorable change has set in, convalescence is generally pretty rapid, although Mondière asserts that he was obliged to take his food cold for many months after recovery from the acute symptoms. If, as is usually the case, the inflammation gradually subsides, the difficulty of swallowing and other symptoms pass off; but if ulceration should take place, the symptoms persist in full force, the pain becoming more severe and more constant. If the expectoration is frequently tinged with blood, ulceration may be suspected.

Pathology.—It is probable that in acute œsophagitis the usual phenomena of catarrhal inflammation of mucous membrane are present—that is to say, there is great redness of the membrane, together with succulence of the epithelium and increased secretion of watery fluid containing imperfectly developed epithelial cells. The abundant secretion which occurs during life comes not only from the œsophagus but from the pharynx and the salivary glands, which appear to be sympathetically stimulated. Zenker and Ziemssen,[1] following Klebs, assert that inflammation of the gullet is altogether different from inflammation as it affects other mucous membranes; but this view is not borne out by the only case of idiopathic œsophagitis in which the *post-mortem* appearances have been recorded. In this instance the following changes were observed, chiefly at the upper and lower ends of the tube: "The mucous membrane was red, but not ulcerated, extremely congested and thickened; the glands were more prominent than usual, the mucous membrane was covered in several places with a glutinous gray, or grayish-yellow coating, which could be washed off. On section the submucous tissue appeared to be thickened and infiltrated with liquid. Strong pressure between the fingers made it thinner. There was no pus to be seen. Microscopically, the viscous coating was found to consist of mucus with abundant epithelium cells and pus corpuscles."[2]

Although as a rule the acute inflammation rapidly subsides, yet occasionally it leads to *ulceration*. This appears to have occurred in the case recorded by Paletta,[3] in which a young woman who died from extensive inflammation of the throat, involving the pharynx, larynx, and œsophagus, was found to have a large ulcer on the anterior wall of the gullet. Mondière[4] also mentions the case of a woman who succumbed to an attack of œsophagitis, terminating after four months' illness in ulceration of the œsophagus, for which there appeared to have been no other cause than simple inflammation.

It rarely happens that the inflammation leads to the formation of a distinct *abscess*, though this sequel is common enough in cases of traumatic origin. Three instances, however, are on record, in which œsophagitis terminated in abscess; in one[5] of these the sac was accidentally opened by the pressure of a bougie, while in the others spontaneous rupture occurred, and pus was continuously expectorated, in one case[6] for three or four days, and in the other[7] for a fortnight.

More rarely still the disease ends in *gangrene*. I know of only two instances in which this termination is recorded. In one[8] of these the patient was a man, aged thirty-eight, who was suffering from purpura and general inflammation of the gastro-intestinal canal, and the mucous membrane of the œsophagus was found thickened and of an inky-black color.

[1] Op. cit., vol. viii., p. 135.
[2] Laboulbène: Op. cit., p. 84.
[3] Exercit. Pathol., 1820, p. 228.
[4] Arch. Gén. de Med, t. xxiv., p. 221.
[5] Bourguet: Gazette de Santé, 1823, p. 221.
[6] Padova: Loc. cit.
[7] Barras: Arch. Gén. de Méd., 1825.
[8] Habershon: Diseases of the Abdomen, 1878, third edition, p. 53.

The other[1] occurred in a man, aged sixty, in whom the gullet was found to be gangrenous from its upper extremity to within an inch of the cardiac orifice of the stomach. The whole thickness of its wall was sphacelated, the lining surface, however, being most involved.

It is possible that there may sometimes be a *myalgic* condition of the œsophageal walls rather than actual inflammation, but such a disorder would of itself give rise to no appreciable pathological change.

Diagnosis.—The extreme odynphagia and the absence of all inflammation of the pharynx, or of the framework of the larynx, as ascertained with the help of the laryngoscope, strongly point to acute disease of the œsophagus. The pain which is experienced on pressure of the larynx and trachea backward, is more marked than when the air-passages are themselves inflamed. Mondière attaches much importance to the sensation of heat which is felt at the lower part of the neck, when, at the same time, there is entire absence of any redness in the throat. The same author also refers to the intense anxiety often manifested by the patient, a symptom which is usually aggravated by attempts to swallow even fluids. This has sometimes led to the disease being mistaken for hydrophobia. In that complaint, however, solids can often be swallowed when the very sight or even the sound of fluid will bring on a severe spasm. Moreover, the general hyperæsthesia, asphyxial paroxysms, and psychical phenomena of hydrophobia are all so characteristic that, when once seen, little confusion is likely to arise between that disease and œsophagitis. Pericarditis with abundant effusion sometimes causes pressure on the œsophageal canal, and occasionally gives rise to dysphagia, but seldom to any considerable amount of odynphagia. In pericardial affections, moreover, the pain is generally limited to the epigastric region ; in these cases the physical exploration of the chest at once determines the nature of the affection. It need scarcely be said that in acute inflammation of the gullet neither the œsophagoscope nor the bougie can be used.

Prognosis.—This is generally favorable, but in at least two cases, viz., in that of Padova and in one of my own, the patient was in a very critical condition. In Laboulbène's case, the patient died suddenly from cerebral hemorrhage.

Treatment.—The most important element in successful treatment consists in maintaining the œsophagus in a state of absolute rest. It does not require any persuasion on the part of the physician to secure this condition, for if the symptoms are at all severe, the patient is quite unable to swallow. Nutrient enemata should be administered, unless the inflammation rapidly subsides, and morphia must be given hypodermically. Poultices should be applied along the upper part of the spine ; or if there be much pain, anodyne embrocations, such as the oleate of morphia (gr. $\frac{1}{10}$ ad $\frac{\text{ss}}{}$ j.) and belladonna liniment, may be rubbed into the back. Mondière insists on the importance of venesection, cupping, leeching (from twelve to thirty leeches being applied to the side of the neck), counter-irritation (mustard poultices and moxas), and derivatives. General bleeding, however, or even the local abstraction of blood to the extent recommended by Mondière, is not likely to be carried out in the present day, and I have not found any benefit from counter-irritation. Derivatives, on the other hand, especially very hot pediluvia, are often of signal service. Bleuland used blisters "*loco dolenti*" between the shoulders with success.

Pagenstecher[2] has reported two cases in which he attributed consider-

[1] Arch. Gén. de Méd., t. xxiv.

[2] Journal von Hufeland, 1827, p. 51.

able importance to the internal use of hydrochlorate of ammonia. It may be remarked, however, that fifty years ago this drug was highly lauded by physicians (especially the Germans and Dutch) as a remedy for almost every kind of disease.

The passage of bougies can only do harm, and should never be attempted, in spite of a case related by Mondière,[1] in which an abscess was accidentally ruptured in this way, and the patient thereby cured.

When convalescence commences, the change from a liquid to a solid diet should be very gradual, and should pain in deglutition recur, the patient must be again immediately restricted to fluids.

CASES ILLUSTRATING ACUTE ŒSOPHAGITIS.

Case 1.—Mr. A. W., aged twenty-six, applied to me in July, 1868, on account of great pain and difficulty in swallowing. He stated that he first noticed this two days previously, and that it came on the morning after he had been at a ball where he had eaten several ices. He acknowledged that he had become very hot in dancing, and had gone out of the ball-room into the open air though the evening was fresh ; but he attributed the throat affection to eating ices, because he had once before had a similar attack produced in that way, while he had often exposed himself to cold after dancing without any ill effects. He said that he had scarcely been able to swallow any food for the last two days, having been quite unable to take solids, and fluids causing great pain. He had slept very badly the last two nights, owing to the quantity of saliva, which repeatedly woke him by giving rise to attacks of coughing. When first seen by me, his condition was as follows: He swallowed some water, which caused great pain opposite the seventh dorsal vertebra, and which he said darted upward to the back of his throat. His power of deglutition was then tested with solids, and it was proposed that he should try bread, meat, and potato. He succeeded in getting down a small piece of stale bread, but was obliged, at the same time, to drink water ; the effort, however, caused him very great pain, and he was unable afterward to swallow either the meat or the potato. On examination with the laryngoscope, the pharynx and larynx were seen to be quite normal. This patient was treated with hypodermic injections of morphia, b it they were used only five times. For two days nutritive enemata were employed, but afterward the patient sucked ice and swallowed iced milk and cold beef-tea. Nine days after the first occurrence of the inflammation he was able to take semi-solids, and a few days later he could swallow any cold or tepid food. At the end of a month he was still obliged to be careful in his diet.

Case 2.—Charles E., aged forty-one, night watchman in a warehouse, came under my care at the London Hospital in February, 1873, on account of chronic rheumatism affecting the right knee and left ankle. The patient had suffered from two attacks of acute rheumatism, for both of which he had been treated in the hospital. He was placed on iodide of potassium and bicarbonate of potash. After being under treatment for a month with slight benefit he was suddenly attacked by severe odynphagia, together with a constant flow of glairy saliva. He experienced, just above the level of the upper border of the sternum, a burning pain, which was greatly increased by pressure on the front of the trachea. For three days the patient was unable to take any food or drink, and he was scarcely able to sleep at all owing to the mucous secretion passing down into the larynx, whenever he began to lose consciousness, and giving rise to paroxysms of coughing. He was obliged constantly to sit up and support his head between his hands. The pharynx and upper part of the larynx were seen to be healthy. Nutrient enemata were administered on two occasions, but the patient objected to them so much that they had to be discontinued. Subcutaneous injections of morphia relieved the constant burning pain, but did not produce sufficient anæsthesia of the œsophagus to allow deglutition. On the fourth day from the establishment of the severe symptoms the patient was able to swallow a little milk, and at the end of a fortnight could eat almost anything when cold, though hot food still caused pain.

Case 3.—Henry E., aged twenty-three, consulted me on June 24, 1875, on account of difficulty of swallowing. He stated that two days previously he had been upset from a boat on the Thames, and that it was some time before he was rescued. After being brought to the shore he became insensible, and remained in this condition for

[1] See ante, case of Bourguet.

more than half an hour. Next day he was very feverish, and in the afternoon felt difficulty in swallowing. In the evening, while trying to take some soup, it was violently thrown back through the nose. The same night he was slightly delirious; he was scarcely able to sleep, being obliged to sit upright and expectorate saliva. The next day, when I saw him, he was feverish, the pulse being 120 and the temperature 105.5 F. He was spitting up large quantities of ropy mucus. The lower part of the pharynx and the epiglottis were seen to be slightly inflamed, but the interior of the larynx and trachea was normal in appearance. The patient swallowed a little water in my presence, but declined to take a second spoonful on account of the great pain it caused. The following day the difficulty of swallowing still continued; the patient complained of severe thirst, but was unable to swallow little lumps of ice, or even iced water. On the morning of the fourth day he was able to get down a small quantity of cold soup, and a few hours later he took a large drink of milk. From this date he rapidly improved, and at the end of a week from the commencement of the attack he was perfectly well. The only treatment in this case consisted in subcutaneous injections of morphia.

Case 4.—Mr. W., aged forty-seven, who had a short time before been suffering from subacute rheumatism, sent for me on May 27, 1879, on account of difficulty of swallowing which had come on the previous evening. Examination with the laryngoscope showed that the larynx was healthy, and the pharynx also appeared quite normal. Mr. W. said that he could swallow, but that it caused him great pain at a point which he indicated midway between the cricoid cartilage and the upper edge of the sternum. There was no expectoration. I ordered the patient to suck ice. In the evening, feeling much worse, Mr. W. sent for me again. He informed me that he was unable to take the ice, as it caused him so much pain. He had begun to expectorate frothy mucus. I administered morphia subcutaneously. The next day he felt better, but could not yet swallow at all. The subcutaneous injection was repeated, and a nutrient enema was administered. (See vol. i., p. 425). The patient was fed by enemata for five days; after this he began to swallow, but for three weeks he experienced difficulty at times. Indeed, one month after the date of the attack, while swallowing a piece of potato he felt so much pain and difficulty that he thought his old symptoms were returning. This, however, did not prove to be the case.

Case 5.—There was nothing remarkable about this case. The patient was a lady, aged twenty-seven, who had recently suffered from rheumatism and pleurisy. The attack of œsophagitis occurred in November, 1880, and was not so severe as those above described. Belladonna plasters applied to the back between the shoulders gave much relief, and no hypodermic injections were used.

ŒSOPHAGITIS IN INFANTS.

As already remarked, Billard [1] was the first to call attention to this affection, and soon afterward Ryan [2] described it in almost identical terms. Though his lectures contain no reference to Billard, there can be little doubt as to the source of his information. Subsequent English writers have altogether passed over the disease.[3]

The predisposing *cause* of the affection in infants appears to be the physiological hyperæmia of the gastro-intestinal mucous membrane which exists at birth. Out of 200 bodies of newly-born children, free from any sign of disease, Billard [4] found the mucous membrane of the œsophagus, as well as that of the isthmus of the fauces, more or less congested, 190

[1] Op. cit., p. 278.

[2] Lectures on Diseases of Infants—Lond. Med. Journ., July 18, 1835.

[3] This is probably to be accounted for by the fact that even in children's hospitals patients under two years of age are not admitted. Within the last two years, however, a hospital has been established in Boston, Mass., by Dr. Havens, which is exclusively devoted to infants *under* this age. Much valuable information concerning the maladies of early infancy is likely to be obtained at this institution, while the problem of artificial feeding will be worked out in a scientific manner hitherto impossible.

[4] Op. cit., p. 274.

times; no ramifying vessels could be seen, but the mucous membrane presented a uniform redness, which did not extend deeper than the epithelial layer. Billard considers that in these cases there was passive congestion, due to the imperfect establishment of the relation between respiration and circulation. Indeed, autopsies made on newly-born infants show conclusively that when the circulation through the lungs, heart, or liver is obstructed, hyperæmia of the œsophagus is almost always present. In older children the same condition is brought about by morbid conditions of the blood, as in fevers and diphtheria. Even when the first months of infantile life have been safely passed through, the œsophageal veins readily become gorged in various affections of the more important organs, as well as in cases of severe general disease. Thus, Steffen [1] reports 10 cases of hyperæmia and 6 of ulceration of the mucous membrane of the œsophagus, out of 44 cases of fatal disease in infants and young children. In most of these there was circumscribed pneumonia, while in 2 there was enteritis, and in 2 *cholera infantum*. In some of Billard's cases, however, it would appear that the morbid changes had actually commenced before birth. The exciting cause of the complaint seems to be sore nipples or a defective quality of milk on the part of the mother or nurse, or improper food.

The principal *symptom* of œsophageal inflammation in children is an unwillingness to suck. When the child, however, can be induced to take the breast it leaves off sucking after a second or two and commences crying. Most of the milk is immediately returned, quite unchanged, a very small quantity probably reaching the stomach. Gentle pressure on the lower part of the trachea will, as Billard [2] has pointed out, often make the child cry.

The *diagnosis* of this affection is very difficult. If occurring at the time of birth, it may be confounded with a congenital malformation of the œsophagus. In the latter case, however, *all* the milk is rejected, and paroxysms of suffocation are brought on by attempts to swallow. On the other hand, in the affection now under consideration, although the child cries after trying to suck, a small quantity of nutriment is retained.

The *pathological changes* vary in different cases. Sometimes the whole lining membrane is inflamed, while occasionally the hyperæmia affects only a limited surface. Ecchymotic patches are often present. Sometimes the inflammation goes on to *ulceration*. The ulcers vary in form and size. Thus, in one of Billard's [3] cases the upper part of the œsophagus was highly injected, and there were two sharply-cut ulcers of oblong shape, each measuring about four lines in its longest diameter. In another of Billard's [4] cases the whole of the upper third of the gullet showed erosions of the epithelium, while in a third instance portions of the epithelial layer were expectorated as broad yellowish shreds; on *post-mortem* examination the mucous membrane exhibited large patches of a bright red color, which appeared to correspond with the membranous material expectorated during life. Ulcers, when present, generally affect only a limited portion of the œsophagus—the upper or lower part—and, according to Steffen,[5] their number is in inverse proportion to their size. It not unfrequently happens that the inflammatory process is confined to the follicles, the orifices of which are often slightly ulcerated, and are surrounded by red rings, which are much brighter than the general purple hue of the rest of the mucous membrane. Occasionally the disease goes on to *gangrene*, one case having

[1] Jahrb. für Kinderheilkunde, N. F. 1869, Bd. ii.
[2] Op. cit., p. 290.
[3] Ibid., p. 276.
[4] Ibid., p. 279.
[5] Loc. cit.

been reported by Billard,[1] in which the lining membrane of the œsophagus presented large loose irregular eschars, the intervening surface being highly inflamed and traversed by deep excoriations.

The *prognosis* is generally unfavorable in these cases, not only on account of the very tender age of the patient and the extreme difficulty of carrying out suitable treatment, but because the œsophageal inflammation is so often associated with pneumonia and gastro-intestinal irritation.

In the *treatment* of this affection it is most important to pay attention to the quality of the milk and the condition of the mother's nipples; or, if artificial nutriment is used, the cooking utensils and feeding-bottles should be carefully looked to. As regards medicine, the remedies found useful in thrush, such as chlorate of potash dissolved in milk, and borax mixed with honey, may be employed. Dr. Ryan[2] strongly recommended antiphlogistic remedies, such as leeching, but it must be remembered that this advice was given nearly fifty years ago, and that the views then in vogue have completely passed away. There is less objection to this author's other suggestion, viz., the application of warm fomentations to the neck.

Phlegmonous Œsophagitis.

It is exceedingly doubtful whether acute inflammation of the submucous areolar tissue ever occurs as an independent affection. It was first described by Belfrage and Hedenius,[3] as occurring in a case in which a fish-bone had become impacted in the throat, and it has since been observed in a case of poisoning by sulphuric acid, but as a rule the injury proceeds from without. Zenker and Ziemssen[4] have reported a number of cases, in most of which the morbid condition resulted from the penetration of abscesses (generally of scrofulous glands) through the external coats of the gullet. The condition is not likely to be recognized during life, and at present must be regarded as a pathological curiosity—the result of the burrowing of pus between the constituent parts of the œsophageal walls. As such it will be referred to in connection with those diseases (traumatic œsophagitis, peri-œsophageal abscess) in which it is occasionally observed after death.

Ulcer of the Gullet.

Although ulceration is present in almost every case of prolonged obstruction of the gullet, there is no conclusive evidence that it ever occurs as an independent disease. None of the cases hitherto recorded present any analogy to the "simple perforating ulcer of the stomach." When a limited surface of the latter viscus is deprived of its supply of blood by embolism or through any other morbid condition, the solvent action of the gastric juice comes into operation, and an ulcer can quickly form. It need scarcely be pointed out that a lesion of this nature could occur in the gullet only under very exceptional circumstances, if at all, during life, and that the œsophageal mucous membrane can, as a rule, be acted on by the gastric juice only after death (see Post-mortem Softening of the Gullet). The cases of "simple ulcer of the œsophagus" which have been re-

[1] Op. cit., p. 288.
[2] Loc. cit.
[3] Schmidt's Jahrb., Bd. clx., p. 33.
[4] Cyclopædia of Medicine, vol. viii., p. 151 et seq. English Transl., 1878.

ported by the older writers are too incomplete to be relied upon, while many modern cases, nearly all of which have been carefully collected by Knott,[1] are open to the objection that the disease may have been of malignant nature, the ulcerated surface not having been submitted to the test of microscopic examination. This observation applies to a case of my own,[2] and to another of Dr. Benson.[3] Again, in other cases of so-called "simple ulceration" there is not the slightest evidence that the morbid process *commenced* in the gullet. In some of the supposed examples the disease probably originated in the trachea. Thus, in a case occurring in the practice of Dr. Gordon[4] the patient had suffered from repeated *attacks of dyspnœa a considerable time before dysphagia supervened.* In other cases,[5] in which the early history is obscure, it is quite possible that the original lesion may have been due to the temporary impaction of a foreign body, to a peri-œsophageal abscess, or even to the penetration of a scrofulous gland. In any of these instances, by the time the autopsy is made, there is often nothing which can reveal the original cause of the malady, and there is at present no ground for considering that ulceration of the œsophagus can take place as an independent process. Ulcers of the gullet may follow œsophagitis,[6] and they are certainly found in cancer, syphilis, and phthisis, as well as in thrush, diphtheria, variola, typhoid fever, and in cases of traumatic lesion.

TRAUMATIC ŒSOPHAGITIS.

Latin Eq.—Œsophagitis traumatica.
French Eq.—Œsophagite traumatique.
German Eq.—Traumatische Entzündung der Speiseröhre.
Italian Eq.—Esofagite traumatica.

Definition.—Acute inflammation of the œsophagus caused by caustics or irritants,[7] giving rise, when very severe, to complete destruction of the walls of the gullet, in slighter cases to limited desquamation, and when mild to active hyperæmia.

History.—Inflammation of the gullet from the action of caustics has been more or less known to physicians since the earliest dawn of scientific medicine, but it is only in modern times that the special effects of the various irritant and corrosive poisons on the mucous membrane of the alimentary canal have been attentively studied. Less attention has, however, been given to the action of such substances on the gullet, probably because its resisting lining membrane, its freedom from recesses, and its perpendicular direction combine to make it much less vulnerable than the mouth or stomach. A mere reference to the various ancient writers who have mentioned cases of œsophageal injury from this cause would possess but little interest. Those, however, who care to look more closely into this matter may consult a list of cases of œsophageal strictures given by Behier,[8] many of which are the result of traumatic œsophagitis,

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[1] Pathology of the Œsophagus. Dublin, 1878.
[2] Trans. Path. Soc., vol. xix., p. 213. [3] Knott: Op. cit., p. 73.
[4] Ibid., p. 68. [5] Ibid., p. 75. [6] See page 21.
[7] Œsophagitis set up by the impaction of foreign bodies is purposely omitted here, the condition of the gullet under those circumstances being so dependent on the nature, position, and ultimate course of the foreign body that it can be best considered in connection with the accidents which give rise to it.
[8] Clinique Médicale, Paris, 1864, p. 113.

and several typical instances may be seen in Luton's [1] article on the œsophagus. Both Casper [2] and Taylor [3] contain much valuable information on this subject.

Etiology.—The disease is nearly always caused by accidental or suicidal swallowing of corrosive poisons, or highly irritant solutions, but occasionally these fluids have been administered to young children with murderous intention.[4] Sulphuric acid, from its common employment for domestic purposes, is often used by poor and ignorant persons for suicide, better educated people generally seeking a less painful poison. Nitric acid is not very easily obtained, and is therefore not so frequently used. Accidents often occur through swallowing soap-lees, a mixture generally consisting of about three parts of caustic soda to eight of water. These strong alkaline solutions appear to be very carelessly used in some parts of Austria, for in five years Keller [5] treated no less than forty-six such cases among children in the Mariahilf Hospital at Vienna.

Symptoms.—The specific action of many of the poisons has already been described under Traumatic Pharyngitis (vol. i., p. 75 et seq.), but a few additional remarks must be made here. In the first hours after the accident the special lesion of the œsophagus does not attract particular notice, the mouth, pharynx, and stomach being generally simultaneously involved, and all claiming attention. If a strong irritant has been swallowed the mouth is excoriated; the surface of the tongue, when the agent is sulphuric acid, being white, and when nitric acid, yellow. In both cases the tongue is swollen, the uvula œdematous, and the pharynx greatly inflamed, and presenting numerous bleeding excoriations. If a laryngoscopic examination can be made, the epiglottis and arytenoid cartilages are seen to be red, and enormously œdematous, or not much swollen, but covered with loose dark-colored shreds and blood-stained mucus. At a later stage of the case, however, morbid changes result, which give rise to very marked œsophageal symptoms. This remark especially applies to the weak alkaline solutions, which often produce cicatricial changes in the œsophagus, while the pharynx, probably owing to its greater lumen, may escape injury altogether.

A peculiar form of œsophageal inflammation is occasionally produced by the action of antimony, which in some cases appears to have a special action on the mucous membrane of the œsophagus, even when administered in medicinal doses. There is a specimen in University College Museum (No. 1052) which is a good illustration of this. Antimony, in ordinary doses, had been given to a patient exhausted by pneumonia, and after death the mucous membrane of the epiglottis and pharynx was seen to be destroyed, and the epithelium stripped off at the upper part of the œsophagus, while at the lower extremity the mucous membrane was completely ulcerated through, the circular muscular fibres being laid bare. There were likewise some smaller patches of ulceration above this point. Vogel [6] has reported a case of poisoning by antimony in which ulcers were

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[1] Nouveau Dict. de Méd. et de Chir., Paris, 1877, t. xxiv., p. 416.

[2] Handbook of Forensic Medicine, New Syd. Soc. Transl., 1862, vol. ii., p. 55 et seq.

[3] Principles and Practice of Medical Jurisprudence, London, 1873, vol. i., p. 211 et seq. Second edition.

[4] Casper (Handbook of the Practice of Forensic Medicine, New Sydenham Soc. Transl., 1862, vol. ii., pp. 75, 78, and 84) reports three cases (Nos. 188, 191, 198) in which mothers killed their infants by administering sulphuric acid.

[5] Oester. Zeit. für prakt. Heilkunde, Nos. 45–47, 1862.

[6] Lehrbuch der Kinderkrankheiten, p. 99.

found in the œsophagus. Sometimes, however, the effects of the poison are shown in the production of pustules. A remarkable instance of this kind is described and figured by Laboulbène,[1] in which the pustules were found scattered throughout the gullet. The action of antimony on the œsophagus is, however, by no means uniform. Thus, in three cases of poisoning by that agent reported by Taylor,[2] in which large quantities were taken, the œsophagus is described as being uninjured in every instance, although in one of them a "burning sensation down the gullet" was complained of during life. In this instance the patient was a girl, aged sixteen, and from forty to sixty grains of antimony had been taken, while in the other cases, occurring in young children, ten grains of the poison had been swallowed.

In briefly describing the effects of poisoning by phosphorus in the article "Traumatic Pharyngitis" (vol. i., p. 76), I omitted to mention two very characteristic symptoms, viz., the belching forth of bluish-white fumes luminous in the dark, and the evacuation of primrose-colored stools.[3]

In cases of injury by irritants the symptoms depend on the strength of the poison. When the mineral acids, chloride of zinc, ammonia, or some other solutions in a concentrated state, are swallowed, they *corrode* the mucous membrane, and give rise to the most serious and painful symptoms, while the dilute acids and weak alkaline solutions set up *acute*, or, in some cases only, *subacute inflammation*.

Immediately after swallowing a *powerful corrosive poison*, or strong caustic, the patient experiences a burning sensation in the fauces and stomach, or he may complain of an agonizing pain at the root of the neck or between the shoulders. In some of the most severe cases, however, in which both the stomach and œsophagus are deeply corroded, the sensibility seems to be blunted, and but little pain is complained of. This probably results from extreme shock to the system. The patient expectorates and vomits either dark-colored fluid or a frothy secretion containing blood and shreds of membrane. The vomiting may continue for two or three days, but occasionally, in the most severe cases, it ceases altogether after three or four hours, and notwithstanding this apparently favorable turn the patient may succumb within a short time. If the larynx is implicated, there is extreme difficulty of breathing, together with troublesome cough. There is usually very great prostration, the pulse being quick and small, and the skin bathed in perspiration. Sometimes, however, there is active vascular excitement, the skin is hot and dry, the pulse hard and quick, and as the result of cerebral irritation, or possibly of some form of intoxication produced by the poison, the patient is very restless, or even delirious. Most patients suffer from distressing thirst, and if they survive there is nearly always obstinate constipation.

In *less severe* cases, when the mineral poisons have been taken in a diluted form, the symptoms are comparatively slight, and resemble those described under Acute Œsophagitis (p. 20)—that is to say, there are inability to swallow and constant expectoration of glairy fluid. The characteristic anxious expression is also present in the countenance. The patient complains of a burning acid, or of an acrid alkaline taste, according to the chemical nature of the poison. In these apparently mild cases,

[1] Op. cit., p. 87.

[2] Op. cit., vol. i., pp. 309, 310.

[3] I am indebted to the editor of the Birmingham Medical Review (October, 1880) for calling my attention to these omissions, and also for a very kind and critical review containing other valuable suggestions.

however, the dangerous symptom of progressive dysphagia may show itself at a later stage.

Pathology.—The morbid changes, of course, depend on the nature and degree of concentration of the poison. In *severe* cases the gullet as a whole may be gangrenous, its walls here and there being even completely perforated by deep ulcers. In these instances the tongue, pharynx, and larynx are almost always extensively implicated in the destructive process. According to Casper,[1] in cases of poisoning by corrosive or irritant substances, "the œsophagus is only in the rarest instances carbonized like the stomach ; generally it is only hard to cut, as if tanned, and of a gray color, and the vascular injection of its mucous membrane may still be recognized." The tissues of the gullet are in fact quite firm, the mucous membrane is gray, and has an acid reaction. In poisoning by corrosive sublimate, the mucous membrane of the mouth, pharynx, and œsophagus generally has a violet tint, but sometimes it is whitish.

When the corrosive action has been less violent, the lining membrane of the œsophagus is of a brownish or ashen color, while its longitudinal ridges are partially corroded, and more or less detached.

In the *milder* cases the mucous membrane is extremely hyperæmic and highly succulent, while there is abundant cell-proliferation ; but it is only in cases where the injury kills through the severity of the gastric affection, while the œsophagus remains comparatively unscathed, that these slight pathological changes can be studied.

It is worthy of note that in some instances the stomach may be seriously injured, while the œsophagus altogether escapes the corrosive action of the poison.[2]

Diagnosis.—It is very seldom that any difficulty in diagnosis can arise, the *immediate* occurrence of the symptoms on swallowing the poison leaving no doubt as to the nature of the affection. Casper,[3] however, points out that in infants it is very important to distinguish between the state of the tongue in poisoning by sulphuric acid and that occurring in thrush.

It is necessary to ascertain, if possible, the nature of the poison that has been taken. If the patient is insensible when the surgeon arrives, and the character of the poison is unknown, the bottles, vials, and vessels in the room should be examined, with the view of discovering some remains of the acrid fluid. If this does not supply the desired information the vomited matter should be tested. Should it happen, however, that the patient has not been sick, emetics should be administered. The use of the stomach-pump, though constantly recommended by surgical writers, is in these cases attended with great risk, as the point of the instrument is extremely likely to be pushed through the walls of the œsophagus.

It is only in dealing with the *sequelæ* of the accident that there can be any doubt as to the nature of the original lesion. Thus, a patient suffering from a stricture brought about by a corrosive poison taken with suicidal intent, is sometimes ashamed to confess the origin of the condition ; and in these cases the question of diagnosis between cicatricial stricture and malignant disease may arise. This subject will be fully considered in the article on Cicatricial Stricture of the Œsophagus.

Prognosis.—The prognosis must depend on the amount and degree of concentration of the corrosive poison that has been swallowed, and also on the extent to which adjacent parts are implicated. In severe cases the absence of pain must be looked upon as a very unfavorable sign. Vomiting

[1] Op. cit., vol. ii., p. 57. [2] Lancet, November 6, 1880. [3] Op. cit., vol. ii , p. 57.

of dark-brown fluid and of membranous shreds, and extreme prostration are generally indications of an early death ; but even in less severe cases it must not be forgotten that stricture is exceedingly likely to supervene. It may be added that though this may be cured for the time, it is almost certain to recur, and that patients who have once suffered from traumatic stricture are afflicted with an infirmity which will probably exist all the rest of their life.

Treatment.—Acids should always be neutralized by the administration of alkalies largely diluted in water, barley-water, or milk. Carbonate of soda, potash, and magnesia are the best remedies, but any alkali that can be obtained, such as chalk, whiting, or even the scrapings from a white-washed ceiling, should be at once administered. Sal volatile is generally at hand and can be given freely diluted.

In the case of poisoning by phosphorus, carbonate of magnesia should be given in drachm doses every fifteen minutes till the breath ceases to be phosphorescent.

If the poison has been an alkali, acids should *not* be used, as they increase the inflammation, but oil or melted butter should be given. Hot poultices should be applied over the lower part of the neck and to the back along the course of the gullet. The thirst must be assuaged by iced drinks. Very little food, and that only of the blandest character, should be allowed to be taken by the mouth, but the patient should be fed from the very outset by nutritive enemata, and anodynes should be given subcutaneously. Should the patient recover from the immediate effects of the injury, prompt and persevering measures must be adopted to prevent the obliteration of the canal by cicatricial contraction.

As cases of corrosive poisoning are so common, and nearly every pathological museum in London contains specimens of the accident, I do not think it necessary to append any examples.

It may not be out of place to mention that *traumatic œsophagitis* occasionally arises from the stings of insects accidentally swallowed. In these cases the inflammation develops suddenly ; there is extreme odynphagia, as well as a burning pain at the seat of the sting. The patient is generally very prostrate and alarmed. If able to swallow at all he should be induced to take a weak alkaline solution, which generally gives immediate relief. Should the pain be severe, morphia must be administered hypodermically. In a case related by Ranse [1] the sting was quickly followed by a swelling in the neck corresponding to the supposed site of the sting in the gullet, just below the thyroid gland on the right side, and by an urticaria-like eruption which affected the body generally, but was most marked on the side of the neck near the same point. The following case occurred in my own practice :

In August, 1877, a gentleman, aged fifty-four, while drinking some beer, suddenly felt a very sharp pain in the gullet at a point corresponding to the episternal notch. This was followed by repeated severe paroxysms of coughing, and at length by vomiting. It was not till the contents of the stomach were brought up and a wasp seen that the nature of the injury was guessed. I saw the patient about three hours after he was stung, and he was then very anxious and rather faint, and complained of something lodging in the throat just above the level of the sternum. The pharynx and orifice of the larynx were seen to be free from congestion. I endeavored to administer a weak solution of ammonia, but the patient could not swallow it. I then gave morphia hypodermically. In the evening the patient felt pretty well, but still could not swallow. The next day he could take liquids but not solids, and deglutition was not fully re-established till nine days after the sting.

[1] Gaz. Méd. de Paris, September, 1875.

CHRONIC ŒSOPHAGITIS.

Latin Eq.—Œsophagitis chronica.
French Eq.—Œsophagite chronique.
German Eq.—Chronische Entzündung der Speiseröhre.
Italian Eq.—Esofagite cronica.

Definition.—Chronic inflammation of the lining membrane of the œsophagus, giving rise to dysphagia and occasionally leading to ulceration.

Etiology.—The observations with regard to the comparative rarity of acute inflammation of the œsophagus (see page 19), apply also to the chronic form of the disease. Many cases of chronic œsophagitis are probably often regarded as examples of gastric irritation, and treated as dyspepsia, which, as will be hereafter shown, occasionally causes, and frequently follows, slight œsophageal inflammation. It is extremely probable, and the point has been insisted on by several writers, that the long-continued abuse of ardent spirits is a frequent source of chronic œsophageal inflammation. Daily experience proves that excessive indulgence in the stronger forms of alcohol irritates and inflames both the pharynx and the stomach; and though the œsophagus possesses greater powers of resistance than either of these parts, it is not likely that it enjoys absolute immunity. The complaint has been attributed to chewing tobacco, but there is no positive evidence on the subject.

Habitual vomiting may sometimes produce the affection, and according to Cornil and Ranvier,[1] it is occasionally brought about by pyrosis. The disease probably sometimes commences in a slight accidental injury such as may be caused by swallowing a hard or pointed substance, or it may arise from taking food either too hot, or of too pungent a character.

It is generally asserted that the disease often follows the acute form of inflammation of the œsophagus, and from the analogy of most disorders of inflammatory nature such a sequence might reasonably be looked for. There is not, however, a single case on record which supports this view, and my own experience, which, though very limited as regards this complaint, is large in relation to the number of published cases, is altogether opposed to the theory that the chronic affection often originates in an acute attack. I have met with one instance in which the disease followed an attack of pleurisy, the pleural inflammation being very localized, and affecting the base of the left lung near the posterior mediastinum. In this case, as the pleura got well the œsophagus became affected, a slight degree of inflammation being set up which lasted for nearly three months. Though acute œsophagitis is comparatively common in infants, the chronic form of the disease appears to be confined to adults. I have never met with it under twenty-five years of age, and most of my patients have been over forty.

As a secondary phenomenon the condition is occasionally seen in phthisis, and when syphilitic ulceration of the gullet occurs, there is no doubt always some associated inflammatory action. In stricture of the œsophagus likewise, whether arising from cancer, syphilis, or injury, chronic inflammation is always present. This is brought about by the irritation of food (often undergoing fermentative changes), which lodges above the stricture, and sometimes probably by the passage of bougies.

[1] Manuel d'Histologie Pathologique, Paris, 1869, p. 769.

Symptoms.—The symptoms of the affection are obscure when the disease is slight, and it is only in rather severe and protracted cases that it can be distinctly recognized. The most marked symptom is discomfort or even pain in swallowing. Solids sometimes cannot be taken at all, while liquids cause considerable inconvenience. The act of swallowing is always performed very slowly. In most of the cases that have come under my notice the inflammation appeared to be at the upper part of the gullet, but I have met with one in which it was in the lower third. There is generally a good deal of expectoration of viscid mucus, but sometimes the sputa are frothy and closely resemble ordinary saliva. There is never such an abundant flow as is met with in acute œsophagitis.

Pyrosis and hiccough are described by most writers as being present, but I have not observed them in any of the uncomplicated cases which have come under my notice. Occasionally chronic œsophagitis follows chronic gastric catarrh, and the two diseases may coexist for a long time. Again, as the existence of chronic œsophagitis compels patients to subsist for a long time almost entirely on liquids, dyspepsia not infrequently follows. Whether the irritation of the stomach be primary or secondary, when once it is established, pyrosis is nearly sure to ensue, and in my opinion must be looked upon as a gastric symptom. In these cases, in addition to the purely œsophageal troubles, gastric pain, flatulent distention of the abdomen, and costiveness are present, while headache and depression of spirits are also complained of.

On auscultating the œsophagus, the descent of the alimentary bolus can generally be perceived to be delayed, while if the surface of the mucous membrane be roughened, a loud harsh noise may be heard accompanying each act of deglutition. When there is much obstruction, air-bubbles, and sometimes perhaps the "morsel" itself, can be heard to ascend. Exploration with the bougie should on no account be attempted, as this is likely to aggravate the mischief.

The disease undergoes a good deal of variation, getting better and worse without any assignable cause ; but a marked tendency to recurrence after any degree of improvement is one of its most characteristic features.

Pathology.—The morbid changes that take place have not hitherto been investigated, for the disease of itself, though causing much inconvenience, never terminates fatally. It is only in cases of cancerous obstruction and stricture that the pathological changes of chronic inflammation of the œsophagus can be studied. In these cases, at a considerable distance from the morbid growth, the vessels are seen to be enlarged and tortuous, while the mucous membrane is irregularly thickened, and often presents numerous ulcers which vary greatly both in size and depth. They are very frequently of a narrow oval form, and as the œsophageal glandulæ are arranged in short longitudinal rows, it is probable that many of these ulcers are of *follicular origin*. There is often considerable proliferation of the areolar tissue beneath and around the ulcerated surface.

Diagnosis.—The disease with which this complaint is most likely to be confounded is spasm of the œsophagus, in which affection there is, probably, always considerable hyperæmia of the mucous membrane. In chronic inflammation, however, the difficulty of swallowing is *constant*, while in spasm it varies to some extent from day to day, and even from meal to meal. The most important point of distinction, however, between these two affections is that while in spasm solids or semi-solids can often be swallowed with comparative ease, in simple chronic inflammation liquids pass down much more readily.

Chronic œsophagitis may be confounded with laryngeal disease in which implication of the epiglottis or arytenoid cartilages has given rise to dysphagia. In these cases the laryngoscope furnishes a means of diagnosis, but it must always be remembered that the two affections may coexist—the œsophageal malady being generally secondary.

The symptoms of incipient cancer are very like those of inflammation, but the former affection is mostly a disease incidental to the decline of life; in persons of middle age the progress of the case can alone enable the surgeon to distinguish between the two conditions.

Prognosis.—There does not appear to be any danger to life from this disease, but it is extremely apt to recur, and any attack may be of a long duration.

Treatment.—The most important feature in treatment is the avoidance of anything that can irritate the mucous membrane. The diet must be confined to soft or liquid food. A bismuth pastil (Throat Hospital Pharmacopœia) taken every half hour or hour, often seems to soothe the mucous membrane; and when the disease is beginning to pass away, lozenges of rhatany, kino, or tannin are now and then of use. Swallowing small particles of ice sometimes gives relief, but occasionally warm mucilaginous drinks are more soothing. There are cases, however, in which all remedies appear to act prejudicially, the most important indication seeming to be the maintenance of the œsophagus as far as possible in a state of rest. If anodynes are required, they should, as a rule, be administered hypodermically. In some cases I have found counter-irritation by means of mustard poultices, blisters, or croton-oil of considerable use. Hot foot-baths, as recommended in acute œsophagitis, sometimes act beneficially.

CASES ILLUSTRATING CHRONIC ŒSOPHAGITIS.

Case 1.—C. S., a butcher, aged forty-seven, applied at the Throat Hospital on January 14, 1874, complaining of difficulty of swallowing, and pain over the episternal notch. He stated that up to that time he had enjoyed good health, although he had been accustomed to drink rather freely. He had latterly noticed a slightly increased flow of saliva. The laryngoscope showed the upper part of the throat to be healthy; on auscultation, great slowness in the act of deglutition was perceived, but there was no special roughness nor apparent obstruction at any one spot. A bougie could not be passed beyond the upper third of the œsophagus. The patient complained very much of the use of the instrument, and spat up about a teaspoonful of blood immediately after it was withdrawn. The next day difficulty in swallowing had slightly increased. He was put upon iodide of potassium, and no food but milk and beef-tea was allowed. A week later he had slightly improved, but alleged that the iodide of potassium caused such a constant disagreeable taste in his mouth that he was unable to take food. The medicine was accordingly discontinued. In a few days the patient appeared a little better, the pain in the neck being less, and he stated that he had eaten some bread and milk. The probable inflammatory nature of the disease was now first recognized, and the patient was persuaded to become a "teetotaller." He was given bismuth mixture, and ordered to discontinue crying out the price of food, inviting customers, etc., after the manner of butchers in the poorer quarters of London. At the end of March the man was quite cured, and was able to eat and drink anything without difficulty. In February, 1876, this patient had a second attack, which, however, was of milder character, and entirely passed off in three weeks.

Case 2.—Mr. T. S., a farmer, aged twenty-nine, consulted me on November 11, 1876, on account of difficulty in swallowing. He stated that until recently he had been a strong, healthy man, and had always been temperate. In addition to the dysphagia there was slight odynphagia, besides an increased flow of saliva and pain between the shoulders. The affection had come on gradually about three months previously; the patient had neither pyrosis, sickness, nor any other symptom of indigestion. Examination with the laryngoscope showed the larynx and pharynx to be

healthy. On auscultation of the gullet, slowness in swallowing and decided obstruction opposite the fifth dorsal vertebra were plainly perceived. An attempt to pass a bougie failed, the point of arrest appearing to be at the orifice of the œsophagus—much higher than auscultation had indicated. [The difficulty was probably caused by spasm, but the patient refused to permit an examination under an anæsthetic.] On November 12th, the day following the attempt to pass the bougie, the patient was unable to swallow at all, and he became very much alarmed. A hypodermic injection of morphia was given at 8 P.M., and after a good night he was able to swallow nearly as well as on the 11th. In the course of a few weeks he quite recovered.

VARICOSE VEINS OF THE GULLET.

Latin Eq.—Varices œsophagi.
French Eq.—Varices œsophagiennes.
German Eq.—Varicositäten der Speiseröhre.
Italian Eq.—Vene varicose del esofago.

Definition.—Enlarged veins at the lower part and occasionally at the middle third of the œsophagus, generally resulting from some obstruction of the portal circulation, occasionally rupturing and giving rise to hæmatemesis.

History.—Hemorrhage from the gullet was recognized by Galen,[1] but after his time there is no allusion to the subject till the early years of the present century, when a varicose condition of the œsophageal veins was mentioned by Portal[2] as sometimes giving rise to hæmoptysis. It was not till 1820, however, that Peter Frank,[3] pointed out the connection existing between gastric hemorrhage and obstruction of the portal circulation, and thus paved the way for the elucidation of œsophageal bleeding. In 1840 Rokitansky[4] published an instance of fatal hemorrhage from enlarged œsophageal veins. In 1853 Gubler,[5] in comparing the loss of blood from enlarged hemorrhoidal vessels with some forms of hæmatemesis, called attention to the analogy in the distribution of the veins at each end of the digestive tract, and described the peculiar arrangement of the veins at the lower part of the gullet. In 1858 Fauvel's[6] case (which had been observed in 1837 and referred to by Gubler in the work just cited) was published, together with one by Lediberder. In the following year Bristowe[7] related a case, and in 1874 an example was published by Ebstein.[8] Since then, Audibert[9] and Dusaussay[10] have treated the subject in short monographs, and Duret[11] has given a clear account of the anatomical conditions leading to the development of the affection. Zenker[12] has devoted to it a few pages of his valuable article on the œsophagus, and quite recently Eberth[13] and Hadden[14] have described instances of the complaint.

Etiology.—According to Galen,[15] hemorrhage may take place from the œsophagus, "ob solam sanguinis plenitudinem," but this theory is not

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[1] De locis affectis, lib. v., cap. iv.
[2] Cours d'Anat. Méd., Paris an xii. (1803), t. iv., p. 539.
[3] Traité de Méd. Prat., t. iii., p. 245.
[4] Med. Jahrb. d. Oesterr. Staates, 1840, Bd. xxi., p. 230.
[5] De la Cirrhose, Paris, 1853, p. 62.
[6] Recueil des Travaux de la Soc. Méd. d'Observ., 1858, fasc. iii., p. 257.
[7] Trans Path. Soc. London, 1859.
[8] Schmidt's Jahrb., 1874, clxiv., p. 160.
[9] Des Varices Œsophagiennes. Thèse de Paris, 1874.
[10] Étude sur les Varices de l'Œsophage. Thèse de Paris, 1877.
[11] Progrès Médical, t. v.,' 1877, p. 304.
[12] Ziemssen's Cyclopædia, vol. viii., p. 130 et seq.
[13] Deutsches Archiv. für klin. Med., 1880, vol. xxviii., p. 566.
[14] Trans. Path. Soc., London, vol. xxxiii., p. 190.
[15] Op. cit., lib. v., cap. iv., sub fin.

likely to meet with acceptance in the present day. Cirrhosis of the liver has generally been considered to be the cause of this affection, but any hepatic disease which obstructs the portal circulation is apt to produce it, and it would appear from Zenker's [1] statistics that the affection occurs with relatively greater frequency in senile atrophy than in cirrhosis. Thus, in 178 cases in which there was advanced chronic (especially senile) atrophy of the liver, œsophageal varices were found 43 times or in 24 per cent., while the varicose condition was present only once, *i.e.*, 5½ per cent., in 18 cases of cirrhosis. In Bristowe's case there was considerable enlargement of the spleen, but the liver was normal. The condition of the portal vein, however, is not described. It must not be forgotten, as Zenker very properly points out, that senile atrophy of the liver is a disease of old age, a period of life at which varices are most apt to occur, and hence that the dilated state of the œsophageal veins must not be regarded as necessarily due to hepatic obstruction. Zenker unfortunately does not mention to what extent varices were present in other parts of the body in his 178 cases. Klebs [2] has met with instances in which the affection was due to syphilitic disease of the liver, and König [3] states that he has also seen a case in which "fatal hemorrhage took place from a varix in the neighborhood of the cardia in a patient suffering from syphilitic hepatitis." As Gubler and Monneret [4] have indicated, there is a tendency to loss of blood from various parts when the liver is diseased. Indeed, even as far back as the time of Hippocrates epistaxis in adults has been considered to be a frequent concomitant of chronic hepatic disease. This no doubt depends on some morbid alteration in the condition of the blood. In the gullet, however, the peculiar relation of the veins at its lower part to the general circulation on the one hand and to the portal system on the other, favors the development of the affection. For, as Gubler remarks, there is toward the cardiac orifice of the stomach a neutral territory, in which two sets of veins meet each other—one set being radicles of the vena azygos, and thus communicating with the general circulation, while the others end in the portal vein through the coronary branch of the stomach. This arrangement probably tends to cause obstruction to the circulation where the two currents meet; and Gubler [5] points out that at the lower part of the rectum, where there is an analogous communication between the systemic and portal veins, hemorrhoids are very common as the result of obstruction.

An additional factor in the causation of these varices is, according to Duret,[6] the relatively large capacity of the œsophageal plexuses as compared with the size of the thoracic veins with which they communicate. Hence, if anything prevents the former from emptying themselves into the coronary veins of the stomach, the blood is necessarily driven back, and the outflow into the bronchial, azygos, and phrenic vessels not being sufficiently free, retardation of the current is produced, the œsophageal plexuses become distended, and, if the cause continues, varix results. Paul Bert [7] has shown that each act of inspiration tends to increase the quantity of blood in the thoracic veins; it can, therefore, easily be understood that when, owing to the conditions which have just been described, these vessels are already over-full, bodily effort or any other influence

[1] Op. cit., vol. viii., p. 132. [2] Hand. der pathol. Anat., 1868, Bd. i., p. 162.
[3] Deutsche Chirurgie v. Billroth u. Lücke.—Krankheiten des Pharynx und Œsophagus, p. 30. [4] Gubler: Op. cit., p. 69. [5] Op. cit., p. 62.
[6] Progrès Médical, 1877, t. v., p. 306. [7] Quoted by Duret: Loc. cit.

causing increased frequency of breathing favors the production of varix, or even rupture.

It is possible, also, that, owing to the vertical position of the gullet, gravitation may play some part in the production of varicose veins, in the same way as it does in the legs.

Symptoms.—Occasional hæmatemesis occurring in elderly people in whom there is reason to suspect disease of the liver, kidney, or spleen, is suggestive of the existence of varicose veins of the gullet. It is seldom, however, that the disease can be recognized with certainty during life except by the aid of the œsophagoscope, and even with this instrument it is often impossible to detect the enlarged veins, which may be altogether at the lower part of the gullet. In one of the two cases I have met with, however, I succeeded in seeing the dilated veins during life. In both cases the patients complained of an uneasy sensation in the throat, and in one of them constant hiccough was a marked feature; but as the patient was a confirmed drunkard, this symptom has no special significance as regards the complaint now under consideration. In some of the recorded instances pain has been complained of in the region of the stomach. The evacuations are sometimes distinctly bloody, but more often tarry in appearance. More rarely the stools are of natural appearance.

Diagnosis.—It is extremely difficult to determine with certainty during life that the disease exists, except in the rare cases in which the desired information can be got by œsophagoscopy. Even in these cases it is not unlikely that the veins of the stomach may also be affected in a similar manner, and that the source of the bleeding may be there.

Hemorrhage caused by the rupture of varicose veins has likewise to be distinguished from that arising from other local conditions. Although none of these has any absolutely characteristic feature by which it can be identified, some special points may be indicated by which the cause of the bleeding may sometimes be recognized. Thus the hemorrhage from perforation by an aneurism is excessively profuse, while in bleeding due to the pressure of a solid tumor or to ulceration, whether malignant or specific, there is a history of pre-existent severe dysphagia. In the case of foreign bodies, the occurrence of the accident is usually known.

Pathology.—The general pathology of the disease has already been described in dealing with the etiology, and it only remains to make some remarks on the local condition. It is probable that the œsophageal veins are more frequently dilated than is generally supposed, for out of 18 gullets taken altogether at random, in 7 I found more or less dilatation of the submucous veins, while there was distinct, although slight, varix in 2 cases. In 4 instances the enlargement was above the middle of the tube, in 3 it was at the lower end, and in 1 both the upper and lower portions of the gullet were affected, the intervening surface, to the extent of 4 inches, being normal in appearance. In all the cases the enlargement was most conspicuous on the front wall of the gullet, and varied in degree from well-marked arborescence of engorged venules to black, bead-like prominences, connected with vessels of about the size of the angular vein of the face. Although they were not examined microscopically, it seems certain that these nævoid points were true vascular expansions and not ecchymotic patches, for they could neither be washed nor scraped off. It may be remarked that the mucous membrane itself was perfectly free from redness, although until it was stripped off it appeared colored by the enlarged underlying vessels. It may be added that, so far as was known,

none of the subjects from whom the specimens were taken had shown any sign of œsophageal trouble during life.

In Eberth's[1] case there was chronic catarrh of the intestinal mucous membrane, and he thought that this condition had led to general phlebectasis of the chylopoietic viscera. Not only was the rectum the seat of large hemorrhoids, but the vessels of the liver were in many parts much dilated, and at one spot formed a true erectile tumor. The coats of the collapsed œsophageal vein, from which the bleeding had taken place, were extremely attenuated, and the vessel itself was so superficial in situation that to the naked eye it appeared to be lying quite bare of any mucous covering.

Treatment.—There is but little to be done in the way of cure, though the hemorrhage can generally be arrested by making the patient swallow a strong styptic. Among remedies of this kind the mixture of tannic and gallic acids contained in the Throat Hospital Pharmacopœia, under the name of Gargarisma Acidi Tannici fort., is probably the most effectual. Treatment is of little avail as regards the varicose condition of the vessels, and it is seldom that the hepatic disease upon which it depends can be relieved.

CASES ILLUSTRATING VARICOSE VEINS OF THE GULLET.

CASE 1.—Mr. H. B., aged fifty-nine, consulted me in January, 1875, on account of a constant uneasy sensation in the throat, and occasional attacks of spitting of blood. The patient was an exceedingly stout man, of dull gray complexion, and of a generally unhealthy appearance. Though seldom drinking to intoxication he had freely partaken of spirits for the last forty years. He stated that he had been quite well till two years before, when he had had slight jaundice. Since then he had attacks at intervals, but they had generally not lasted more than a few days. Since the commencement of his illness he had occasionally had rather severe feverish colds, accompanied by pain over the liver. Six months after he first became ill he had severe bleeding from the nose, which broke out at intervals during a week, and was at last arrested only with the greatest difficulty. On physical examination, owing to the extreme obesity of the patient, it was very difficult to make out the limits of the liver. The heart-sounds seemed very feeble, but no murmur or other evidence of disease could be detected. Examination of the throat showed that the pharynx was much relaxed, the uvula elongated, and the mucous membrane of the larynx slightly congested. On February 7th I was summoned to see Mr. B. on account of what was called "spitting of blood," but on arriving I found that the hemorrhage occurred in a gush with slight retching, and was clearly of the nature of hæmatemesis. There had been three gushes of blood, amounting in the aggregate to eleven and a half ounces. I directed the patient to swallow a small quantity of the Gargarisma Acidi Tannici fort. of the Throat Hospital Pharmacopœia, and no more hemorrhage occurred on that occasion. The patient, however, was greatly weakened by the loss of blood, and a few days later had a severe attack of diarrhœa. Two subsequent bleedings from the throat took place in March and April, and at the beginning of May the patient was attacked with bronchitis and died in a few days. The following are the notes of the autopsy, which was made by Mr. Poyntz Wright thirty-six hours after death. Rigor mortis not perceptible; subcutaneous tissue loaded with fat; lungs very œdematous in the lower third, especially at posterior part; mucous membrane of bronchial tubes bright red and covered with frothy mucus; left lobe of liver much reduced in size, right lobe slightly smaller than normal; surface hob-nailed; substance hard and dry on section. Numerous ecchymotic spots were seen beneath the lining membrane of the stomach, one being as large as a penny, but most of them much smaller. On opening the œsophagus the veins at its lower part were seen to be enormously enlarged. Six large veins with free anastomoses ascended for about two inches, while two of these reached considerably above the middle third of the tube. Three small, hard, whitish, vertical cicatrices were seen three-fourths of an inch above the cardia, and one larger and redder cicatrix three inches from that point.

[1] Loc. cit.

CASE 2.—Mr. M., a hotel-keeper, aged fifty-one, was sent to me in October, 1880, by Dr. Robert Cross, of Craven Street. The patient, who had been a free liver, complained of a disagreeable sensation in the throat, with a constant feeling of sickness and frequent hiccough. Examination of the throat showed great relaxation of the mucous membrane of the pharynx and larynx, and elongation of the uvula. A portion of it was subsequently removed, with considerable relief to the symptoms. After about two months, however, the patient began to experience slight difficulty in swallowing. On examination with the œsophagoscope a dark round tumor about the size of a pea, with a black streak passing into it both above and below, was seen, rather below the middle of the œsophagus, and I had little doubt but that this object was an enlarged vein. As the examination was exceedingly disagreeable, the patient would not submit to a second exploration. Nevertheless, I felt justified in writing to Dr. Cross, expressing my opinion that the patient had varicose veins of the gullet, and that hemorrhage was likely to occur. Up to this time it must be observed there had not been the slightest sign of hemorrhage. A month later my prediction was verified, for a sudden attack of hæmatemesis came on. This was repeated on several occasions, but though a large quantity of blood was brought up, the stools had only once a tarry character. This fact makes it almost certain that bleeding came from the gullet and not from the stomach. In August, 1881, after a severe outburst of hemorrhage, a fatal attack of *delirium tremens* supervened. No post-mortem examination was allowed.

PERI-ŒSOPHAGEAL ABSCESS.[1]

(SYNONYMS : POST-ŒSOPHAGEAL ABSCESS. RETRO-ŒSOPHAGEAL ABSCESS).

Latin Eq.—Abscessus peri-œsophageus.
French Eq.—Abcès péri-œsophagien.
German Eq.—Periœsophagealabscess.
Italian Eq.—Ascesso peri-esofageo.

Definition.—An inflammatory swelling containing pus, generally originating in the lymphatic glands adjoining the œsophagus, but sometimes commencing in the areolar tissue, and more rarely induced by caries of the vertebræ. In adults the abscess occasionally penetrates the muscular coat, and gives rise to diffuse suppurative inflammation of the submucous areolar tissue, and as a still rarer sequel, a cicatricial diverticulum of the œsophagus may result.

History.—It has been already pointed out that it is useless to attempt to separate into two classes abscesses which are formed in the neighborhood of the pharynx and those developed in immediate proximity to the gullet. The older writers made no such distinction, and accordingly in an historical retrospect it will be convenient to treat the whole subject together. The first notice of abscess in the pharyngo-œsophageal region dates as far back as in the second century of the Christian era, when Galen[2] related a

[1] Although the term "*post-pharyngeal abscess*" is an appropriate one, as abscesses frequently form behind the back wall of the pharynx, the expression "*post-œsophageal abscess*" is less accurate, inasmuch as purulent collections in proximity to the œsophagus are quite as often at the side of the tube, or even in front of it, as behind it. It is true that for practical purposes there is no difference between an abscess of the *lower part of the pharynx* and one behind the *upper part of the œsophagus*: but there is a very wide difference between an abscess on a level with the hyoid bone and another occurring some inches below the cricoid cartilage. In point of fact, the pharynx is so broad, and extends laterally so far into the neck, that an abscess situated at one side of it practically becomes a *cervical* abscess, and is generally very properly treated as such.

[2] De locis affect., lib. v., cap. iv.

case which had occurred in his own experience, and which terminated in spontaneous rupture. From his manner of alluding to the case it would appear that he had seen several examples of the same kind, most of which had ended fatally. No mention of the complaint was made by any other writer, so far as I am aware, till the middle of the eighteenth century, when we meet with Morgagni's [1] careful description of a case in which an abscess pressing on the œsophagus and trachea caused the patient's death by opening into the latter tube. In 1785 Bleuland [2] mentioned that his master, Van Doeveren, had seen a fatal instance of the disease at Groningen. In 1819 Abercrombie [3] reported three cases of retro-pharyngeal abscess which he had met with in young children, and he seems to have been the first physician who recognized the idiopathic character of the affection. He was under the impression that the disease had never before been described, and he mistook his first case for croup. Sir Astley Cooper [4] refers to two examples which he had seen in adults, the dissection of the first leading him to the diagnosis and successful treatment of the second. In 1839 Petrunti [5] published a case which he cured by making an incision into the œsophagus. In 1840 Fleming [6] described the affection with considerable detail as it occurs in the upper part of the neck, reporting three cases which had come under his own notice, and giving a drawing of an instrument devised by himself for the safe opening of such abscesses. In 1841 Ballot [7] described a case of abscess in close relation to the gullet. Mondière [8] followed in 1842 with a collection of cases gathered from many sources, and a year later Duparcque [9] made some interesting observations on the subject. More recently Caulet,[10] Gillette,[11] and Gautier [12] have contributed to the literature of the disease.

Etiology.—Peri-œsophageal abscess, regarded as a distinct disease, probably nearly always commences in the glands in the neighborhood of the gullet, though, in some instances, it may possibly originate in the areolar tissue. In some rare cases it appears to have its starting-point in a distinct tubercular deposit.[13] As an occasional feature accompanying caries of the vertebræ, it is also sometimes met with, but this form of abscess need only be referred to in connection with diagnosis, its treatment coming within the province of the orthopædist or general surgeon. The glandular inflammation may be either *primary* or *secondary*—that is to say, it may occur in a child previously apparently healthy, or it may be developed in the course of an eruptive fever. The special predisposition to glandular inflammation in young subjects is too well known to require comment. It has been suggested that the irritation of the glands in these cases takes its rise from difficult dentition,[14] and I have no doubt that it is sometimes also connected with post-nasal disease, *e.g.*, chronic catarrh, or adenoid vegetations. According to Barthez and Rilliet,[15] abscesses in connection with the upper part of the food-tract are most frequently met with in the four earliest years of life, especially in the first. The cause of the disease is, however, often obscure, and in one of Petrunti's [16] cases the origin was attributed to "catching cold." Though the affection is often met

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[1] De sedibus et causis morb., tom. ii., lib. xv., art. xv.
[2] Observ. anat. med. de sanâ et morbosâ œsophagi struct. Lugd. Batav., 1785.
[3] Edin. Med. and Surg. Journal, vol. xv., p. 259 et seq.
[4] Princ. and Pract. of Surgery, ed. by A. Lee, 1836, vol. i., p. 79.
[5] Gazette Médicale, 2e série, t. vii., p. 122.
[6] Dublin Journ. of Med. Science, vol. xvii., p. 41 et seq.
[7] Arch. Gén. de Méd., 3e série, t. xii., p. 257 et seq.
[8] L'Expérience, January and February, 1842.
[9] Gaz. des Hôpitaux, 1843, p. 105.
[10] De la Péri-œsophagite. Paris, 1864.
[11] Des Abcès pharyngiens. Paris, 1867.
[12] Des Abcès rétropharyngiens. Genève et Bâle, 1869.
[13] Laboulbène: Anat. Pathol., Paris, 1879, p. 89.
[14] Fleming: Loc. cit., p. 41.
[15] Maladies des Enfants, Paris, 1853, second edition, t. i., p. 243. [16] Loc. cit.

with in infants, early life as compared with adult age does not exhibit that preponderating frequency which is seen in the case of the similar abscesses involving the pharynx. Occasionally the malady is distinctly pyæmic in character. Thus there is a case in Guy's Hospital Museum in which purulent inflammation following amputation of the arm extended through the axilla to the root of the neck, and gave rise to a peri-œsophageal abscess which ultimately involved all the tissues of the gullet. A case described by Ziesner[1] appears to have had a similar origin. The patient had suffered from puerperal fever and from abscesses in the ovary and kidney; a collection of pus was formed between the vertebral column and the gullet, finally bursting into the latter.

Symptoms.—These depend on the size, seat, and stage of development of the abscess. Its size varies, as a rule, from a hazel-nut to a hen's egg, but in some cases the sac attains enormous dimensions. The space corresponding to the interval between the fourth and seventh cervical vertebræ is a common seat of the affection; but a purulent collection may form in connection with any part of the œsophagus. Follin and Duplay[2] state that an abscess at the upper part of the food-tract is more often situated laterally than in a central position. Whatever may be its original site, however, the abscess, especially if chronic, as it increases frequently gives rise to a swelling on the side of the neck.[3] Hocken[4] has reported a case in which a fluctuating tumor of this nature reached as high as the mastoid process. Even if the abscess itself is at a considerable depth from the surface it may cause extensive œdema of the cervical region. In two cases related by Petrunti[5] the thyroid cartilage was pushed forward; lateral displacement may also occur, though this is probably very rare. In the early stage of the complaint the local symptoms are vague, there being usually nothing more than a feeling of dryness and swelling within the throat, accompanied, perhaps, by some slight tenderness in the neck if it be the upper part of the food-channel that is affected. Pain in swallowing is generally present from the outset; it is at first localized in some particular part of the canal, but soon begins to radiate—usually in an upward direction—and may be referred to the entire length of the gullet. Any movement of the neck is also extremely painful, but even when the parts are at rest there is a constant throbbing pain, if the disease is acute. As the abscess develops dysphagia begins to be felt, deglutition gradually becoming all but impossible, not only from actual obstruction to the passage of food, but also from the inability of the patient to make the required muscular effort. As a rule, however, a bougie can be passed, and in two instances mentioned by Caulet,[6] this circumstance led to the erroneous inference that there was no compression of the œsophageal canal. If the abscess press on the windpipe there is, of course, some dyspnœa—which is generally more marked during the act of swallowing, the food in its passage down the gullet narrowing still further the tracheal lumen. The voice is generally altered, and occasionally, according to Duparcque,[7] it has a very peculiar character, resembling the "quack of a duck." Cough is not a constant symptom, and, when present, is too slight to be trouble-

[1] Rarus œsophagi morbus. See Disputat. Hallerii, Lausannæ, 1760, vol. vii., p. 629.
[2] Traité Elém. de Pathol. externe, Paris, 1877, t. v., p. 252.
[3] Mondière: L'Expérience. 1842.
[4] Journ. des Connaiss. Méd. Chir., Juillet, 1843.
[5] Gazette Médicale, 1839, 2e série, t. vii., p. 122.
[6] De la Peri-œsophagite, Paris, 1864, p. 32.
[7] Annales d'Obstétrique, t. ii., p. 21.

some. The head is in most cases kept rigidly upright; occasionally, however, when the abscess is situated high up, the neck is thrown backward almost as in opisthotonos, while, if the disease is at a lower point, the patient's chin may be drawn down toward his sternum.

The malady usually runs an acute course, and it is probably only when it originates in vertebral caries that it has a chronic character. It may end in spontaneous rupture of the sac, the contents being discharged into the gullet, from which they are at once expectorated. If the abscess, however, is large, its sudden evacuation in this manner is attended with considerable danger, for the matter may find its way into the larynx, and cause suffocation. On the other hand, the pus may penetrate the muscular coat, and burrow rapidly in the submucous tissue, giving rise to true phlegmonous œsophagitis or *suppurative inflammation of the gullet*. This complication, however (see Pathology), is most uncommon, and when it does occur, there is little change in the symptoms. In some cases the inflammation becomes gangrenous, when death quickly ensues, with the usual typhoid symptoms. Gautier [1] has collected six instances in which this sequel was observed, the abscess in all of them being connected with the upper part of the food-tract.

The symptoms differ to some extent in children and in adults. In the former the abscess is, in the majority of cases, at the upper part of the neck, and, according to Barthez and Rilliet,[2] one of the earliest signs of the disease is a peculiar form of dry coryza, which shows itself within the first few days of the invasion. In children, moreover, the constitutional disturbance is generally very great; there is a considerable degree of fever at the onset of the malady, and rigors ensue as suppuration becomes established. Brain symptoms, such as convulsions and coma, are not unfrequent; they are more likely to occur when the abscess, being situated laterally, impedes the circulation through the large vessels, or presses on the vagus or spinal accessory nerve. In a case reported by Fleming,[3] the child, which was comatose when lying on its back, recovered consciousness when placed in a sitting posture.

In adults the onset of the complaint is not, as a rule, so sudden as it is in children, nor are the constitutional symptoms so severe. Nausea and vomiting may occur, and fever sets in with frequent rigors as the disease develops. The patient often exhibits an extraordinary anxiety of countenance, even at an early period of the complaint.

The above description must be understood to refer to simple abscess produced by inflammation of the peri-œsophageal areolar tissue or of the lymphatic glands contained in it. Where the disease owes its origin to caries of the vertebræ the development of the abscess is slow and unattended with febrile disorder, and it consequently acquires considerable bulk before attention is drawn to it. In such case, moreover, previous symptoms of spinal mischief are sure to have shown themselves. Even if there be no curvature, tenderness over the affected part and diminished mobility of the vertebral column can be detected on careful examination.

Diagnosis.—The disease may be mistaken for croup, such careful observers as Abercrombie [4] and Carmichael [5] having fallen into this error. The dysphagia and stiffness of the neck which are present in peri-œsophageal abscess are, however, essential points of distinction. In true croup, moreover, the pharynx generally presents some traces of false membrane, while

[1] Des Abcès rétropharyngiens. Genève et Bâle, 1869.
[2] Op. cit., p. 420. [3] Dublin Journ. of Med Science, 1840, xvii, p. 43.
[4] Loc. cit. [5] Trans. of King and Queen's Coll. of Phys. in Ireland, vol. iii.

shreds can almost always be found in the sputa. The continued severity of the symptoms in peri-œsophageal abscess also serves to distinguish the disease from croup, which either terminates fatally or ends in recovery in a few days. Where the laryngoscope can be used it furnishes a ready means of differentiation.

The disease can scarcely be confused with œsophagitis, in which a constant flow of saliva and extreme odynphagia are always present. Pericarditis with great effusion may simulate the affection, but physical exploration of the præcordial region will at once reveal the real nature of the case. Peri-œsophageal abscess may occasionally present a likeness to hydrophobia, in that liquids cannot be swallowed, but the characteristic terror is absent, and, moreover, the difficulty is still greater as regards solid food.

Pathology.—When the abscess is formed at the upper part of the throat, it is almost always situated *behind* the food-tract. In thirty-eight autopsies Gautier[1] found it in this position in every case. The abscess occasionally pierces the muscular coat of the œsophagus, and while remaining beneath the mucous membrane rapidly sets up *suppurative inflammation* of the whole circumference of the pharyngo-œsophageal canal. The inflammation may be limited to a small section of the canal, or may involve its entire length, the extension being favored by the arrangement of the lymphatics in a single layer. (See Anatomy, p. 5.) According to Zenker,[2] who has greatly elucidated this rare affection, the *submucosa* under these circumstances soon becomes converted into a cavity filled with pus, among which bundles of areolar tissue may still be found. In favorable cases the pus bursts through the mucous membrane at several points, and produces cribriform ulcers, which may ultimately heal, leaving small saccular depressions lined with epithelium as permanent evidences of the disease. Occasionally these minute cavities, wherein papillæ may sometimes be found, are bridged across by little bands, which further reduce their orifices. In less favorable cases the *muscularis* becomes involved, the pus disorganizes the fibrillæ, and fatty degeneration of the structure occurs. When the abscess is circumscribed, and has emptied itself into the œsophageal canal, the sac may gradually contract, and in course of healing may draw a small portion of the mucous membrane outward, giving rise to "traction-diverticula" (see Dilatations of the Gullet). In another class of cases the abscess approaches the integument at the root of the neck, and comes within easy reach of the surgeon's knife.

Prognosis.—This is always grave, though many patients recover. The least favorable cases are those dependent on vertebral caries. Peri-œsophageal abscesses are less fatal than similar abscesses in immediate relation to the pharynx.

Treatment.—According to Barthez and Rilliet[3] neither antiphlogistic nor mercurial treatment can arrest the disease, even at its commencement. When once the case has been diagnosed, the neck should be constantly fomented; and if there be any distinct fulness, poultices should be applied over the part. It is generally desirable to feed with the œsophageal tube, but if the tender age of the patient renders this method impossible, recourse must be had to nutritive enemata. A fear of establishing an œsophageal fistula or even a diverticulum has sometimes prevented surgeons from making a prompt incision into the abscess; but this danger is comparatively slight, penetration of food into the tissues being only

[1] Op. cit., p. 20.

[2] Ziemssen's Cyclopædia, vol. viii., p. 147.

[3] Op. cit., p. 243.

likely to occur in cases of a decidedly gangrenous character. Where practicable the abscess should be opened; but otherwise, when there is reason to believe that suppuration has taken place, emetics may be given, in the hope that during vomiting the sac may burst. Sometimes the surgeon can cut down through the neck, and reach the abscess. A remarkable illustration of this procedure has been published by Petrunti,[1] who made an incision along the anterior border of the sterno-mastoid one inch and a half in length, and dissected carefully down till the œsophagus was exposed, and the situation of the abscess could be clearly made out. On opening the sac, twelve ounces of pus escaped, to the immediate relief of the patient. Drainage was kept up by means of a strip of lint, and the cure was complete in a month. After incision or accidental bursting of the sac the case must be watched, as the opening is very likely to heal up prematurely. When the abscess has been opened, or has burst, deglutition greatly assists in emptying the sac, by causing pressure on its walls.

Tracheotomy is sometimes called for, but as might be expected, does not always relieve the symptoms. This was shown in a case reported by Ballot,[2] in which, however, the disease was mistaken for œdema of the glottis.

THRUSH OF THE GULLET.[3]

(Synonym: Aphtha.[4])

Latin Eq.—Aphthæ œsophagi.
French Eq.—Muguet de l'œsophage.
German Eq.—Soor der Speiseröhre.
Italian Eq.—Mughetto del esofago.

Definition.—Inflammation of the œsophagus occurring in infants, generally accompanying a similar disease of the buccal mucous membrane,

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[1] Loc. cit.

[2] Loc. cit., p. 258.

[3] The fact that aphthæ attack the œsophagus more frequently than the pharynx has led me to treat the subject in greater detail in this section than in the first volume.

[4] The Greek writers used the word ἄφθα (derived from ἅπτω, "I set on fire") for ulcerated spots in the mouth. The English word *thrush* is supposed to be allied to *thrust*, signifying a "breaking out," its earliest occurrence, so far as I am aware, being in Arbuthnot's Practical Rules of Diet, London, 1732 (chap. iii., p. 355), where he defines *thrush* as "small round superficial ulcerations which appear first in the mouth." At present, English writers apply the word *thrush* to any aphthous affection occurring in the mouths of infants; in the words of our great medical classic, "Children in arms who exhibit aphthæ are said to have the thrush" (Sir T. Watson: Lectures on the Principles and Practice of Physic, 1857, fourth edition, vol. i., p. 119). The French, on the other hand, make a great distinction between *aphthe* and *muguet*, the latter being a name derived from the resemblance of the vegetation to the white blossom of the may-flower. Thus the term *muguet* is strictly limited to the parasitic affection in which the *oïdium albicans* is found, while *aphthe* is employed to describe a non-parasitic pseudo-membranous exudation. [The above was in type before the French translation of the first volume of this work appeared. My distinguished friends, Drs. Moure and Bertier, have added a long note in order to "establish a line of demarcation between *aphthæ* and *muguet*, confounded together by the author" (myself). While there is much to be said in favor of the French view, the presence or absence of the minute fungus has not hitherto been accepted by English writers as a sufficient ground of distinction. The difficulty of the subject is not diminished by the admission of Drs. Moure and Bertier that *muguet* rather frequently complicates *aphthe* (see also Dict. Encyclop. des Sciences Médicales, t. v., p. 668).] The German writers (see Niemeyer: Lehrbuch d. Speciellen Pathologie und Therapie, 7. Auflage, Berlin, 1868, Bd. i., pp. 472 and 483) use the words *Soor* and *Schwämmchen*, as the French employ *muguet* for the parasitic affection, while they apply the term *aphthen* to simple exudative inflammation of the mucous membrane of the mouth.

characterized by an exudation creamy in color and consistence, which usually contains large quantities of the parasitic fungus known as oïdium albicans.

History.—In dealing with the history of this disorder, it may be remarked that the buccal affection has been recognized from the earliest periods, while the œsophageal form has only been described in modern times. Hippocrates [1] mentions the fact of newly-born children being liable to aphthæ. Celsus [2] also treats of the subject in some detail, but from his expressions I am inclined to believe that he is speaking of some more serious disease than thrush. Indeed, all the earlier writers seem to have included under the general name of *aphthæ* every form of ulceration affecting the mouth. An approach to a more correct knowledge of thrush was made by Boerhaave,[3] who described it as a papular or vesicular eruption on the mucous membrane of the mouth. Particular attention was attracted to the affection by a very severe epidemic which occurred at the Children's Hospital in Paris in 1766, and some years later a prize of 1,200 livres, offered by the Académie de Médecine for the discovery of the cause of the disease, was divided among four competitors, who all agreed in regarding "muguet" as consisting essentially in a creamy exudation from the inflamed mucous membrane. In 1785 Bleuland [4] related a most remarkable case, in which the œsophagus of an old woman who died from inanition was found filled with "aphthæ albæ," a condition which, in his opinion, gave rise to the fatal aphagia. Baillie [5] gives some drawings of the disease, in one of which the vegetation is seen to occupy nearly the entire length of the gullet. After the publication of Bretonneau's researches on diphtheria in 1821, thrush was classed among false membranes, and treated of from that point of view by Lélut,[6] Véron,[7] and Blache.[8] The latter writer also pointed out the occurrence of the vegetation in adults suffering from wasting diseases, such as cancer and phthisis, and insisted on it as a sure sign of impending death under these circumstances. Billard [9] gives some remarkable examples of the œsophageal form of the disease, which is also noticed by Andral.[10] Valleix [11] studied the malady with much attention, and was familiar with the fact of its occurrence in the gullet. Cruveilhier [12] in his great work gives three plates portraying thrush in the œsophagus. Finally, in 1842 Berg,[13] of Stockholm, was able, by microscopic examination, to establish that the disease is generally of parasitic nature, and owes its existence to a cryptogamic fungus, to which he gave the name *oïdium albicans*. The life-history of this parasite was very completely worked out by Robin [14] in 1853. Two years later Seux [15] published the results of an extensive clinical experience, and while accepting the view as to the parasitic origin of thrush, he endeavors to show that it is essentially a constitutional disorder, the exudation on the mucous membrane being of the nature of an exanthem. Quite recently, M. Parrot [16] has described the minute characters of the disease with the greatest accuracy, concluding that it is a local expression of general malnutrition.

Etiology.—The origin of the disease is not clear, the exact bearing of the fungus which is commonly present being as yet undetermined. It is also often impossible to tell what relation the local affection bears to the extensive visceral disease which frequently accompanies it. Thrush is usually supposed to be more commonly met with in the cold northern

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[1] Epidem., lib. iii.
[2] De medicinâ, lib. vi., cap. xi.
[3] Van Swieten: Comment. in H. Boerhaave aphorismos, t. iii., p. 197.
[4] De sanâ et morb. œsoph. structurâ, Leidæ, p. 71.
[5] Engravings of Morbid Anatomy, London, 1813, tab. ii., fasc. iii.
[6] De la fausse Membrane dans le Muguet, Arch. Gén. de Méd., lxiii.
[7] Observ. sur les Maladies des Enfants. Paris, 1825.
[8] Art. Muguet, Dict. en xxx. vol.
[9] Maladies des Enfants nouveau-nés, Paris, 1828, p. 283 et seq. See also the Atlas d'Anat. Pathol. which accompanies that work, pl. i. and ii.
[10] Précis d'Anat. Pathol., Paris, 1829, p. 161.
[11] Clinique des Maladies des Enfants nouveau-nés, Paris, 1838, p. 237 et seq.
[12] Anatomie Pathologique, Paris, 1835–42, livr. xv., pl. v.
[13] Quoted by J. Müller, Arch. f. Anat. u. Physiol., 1842, p. 291.
[14] Hist. Naturelle des Végétaux Parasites, etc. Paris, 1853.
[15] Recherches sur les Maladies des Enfants nouveau-nés. Paris, 1855.
[16] Clinique des nouveau-nés, Paris, 1877, p. 213 et seq.

countries than in the south, but this view is not absolutely correct. It appears to be much more frequently seen in Paris than in London,[1] and according to Seux[2] it is more common in Marseilles than in Paris. This physician, however, observed that in the capital the disease is more severe than in the southern city, a circumstance which he attributed to causes connected with the nutrition of the little patients. Thus he found that in Paris, on the appearance of the slightest symptom of the affection, the nurses, fearing that the disease might be communicated to their nipples, at once weaned the children, whereas at Marseilles the infants were suckled during the whole course of the malady.

Thrush often invades the œsophagus after it has attacked the mouth and pharynx, but it not unfrequently passes by the pharynx altogether and involves the gullet. Indeed, thrush of the bucco-œsophageal mucous membranes is more common than the coexistence of the affection in the pharynx and mouth. It is, however, extremely rare for the disease to be limited to the œsophagus. Steffen[3] did not meet with a single example of this circumscribed form of the malady in forty-four autopsies on infants who had died from œsophageal disease. Indeed, as far as I am aware, there are but three cases on record[4] in which thrush was found to be confined to the gullet. Unlike the pharyngeal form of this affection, which frequently attacks adults in the last stages of chronic disease, œsophageal thrush is scarcely ever met with except in infants.

Symptoms.—If a child is suffering from aphtha of the mouth, and suddenly shows signs of difficulty in swallowing, it may be suspected that the disease has passed down to the gullet; but if spots can actually be seen in the pharynx, the œsophageal affection will generally soon come on, for when the disease reaches the pharyngeal mucous membrane it almost always extends downward. While the affection is confined to the pharynx it seldom gives rise to any dysphagia, but this symptom immediately occurs when the œsophagus is involved. The local phenomena are generally complicated by serious disease of the internal organs. In the three uncomplicated cases above referred to, the most prominent symptoms were inability to swallow and obstinate vomiting; death took place from marasmus. Wherever situated, thrush is often associated with erythema of the buttocks and enteritis; indeed, Valleix[5] asserts that in new-born children intestinal inflammation hardly ever occurs without thrush.

Pathology.—The disease is found in the œsophagus in three forms: First, as minute adherent, slightly elevated, grayish-white specks, varying from a pin's head to a lentil in size, resembling little drops of tallow, or morsels of curd; secondly, in patches mostly elliptical in shape, the long axis of which corresponds with that of the œsophagus; thirdly, in zones

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[1] In comparing the diseases of infancy in London and Paris, it must not be forgotten that while in Paris infantile affections are carefully studied *from birth* at the Hospice des Enfants-Trouvés by thoroughly trained *internes*, in London children are not admitted into the Children's Hospitals under the age of two years

[2] Op. cit., p. 197.

[3] Jahrb. für Kinderheilk, 1869, Bd. ii., p. 142. It is worthy of note, however, that among these forty-four cases, Steffen has recorded not less than fifteen instances of œsophageal diphtheria (!), a disease which, according to the experience of all other physicians, is extremely rare. It is highly probable that some of Steffen's cases (notably, Nos. 12, 13, 15, 19, 26, and 31) of supposed diphtheria were, in fact, examples of thrush.

[4] Valleix, op. cit., p. 89 (for a full account of this case, see p. 239 et seq. of the same work); Andral, op. cit., p. 161; Bleuland, op. cit., p. 71.

[5] Op. cit., p. 481.

of varying width, covering from one-third to two-thirds of the circumference of the gullet. These zones, according to Parrot,[1] are not generally uniform in elevation, but are alternately raised and depressed ; they vary in hue from pale white to grayish-yellow, the white zones being usually wider than the others.

According to Seux[2] the œsophagus ranks next to the mouth as regards frequency of invasion by thrush, the lower portion of the tube being the part most prone to the disease, which, however, very seldom extends farther down than to within a centimetre of the cardia. In some rare instances, however, the thrush extends beyond the œsophagus, Steffen[3] having reported 2 cases in which not only the whole of the œsophagus, but the stomach and small intestines were implicated in the morbid process. Taking 26 of Seux's cases, and 22 of Valleix's—together 48 examples—the pharynx was involved in 23, and the œsophagus in 32. In 2 of the latter the gullet alone was affected, but in no case was the pharynx the sole seat of disease. As a rule, however, thrush does not involve the gullet except when the mouth is very severely affected.

Although the color of the vegetation, when first formed, is probably always yellowish-white, it is often found after death to be gray, green, or even black, the hue probably depending on the nature of the food and medicine taken, or the matters vomited, and in some cases on degenerative changes of the *materies morbi* itself. The mucous membrane underneath may show only slight injection, or there may be extensive ulceration, or even, as in one of Seux's cases, the walls of the œsophagus may be totally destroyed by gangrene.

The consistency of the exudation varies from that of cream to stout blotting-paper which has been wetted, and it generally adheres to the underlying epithelium with sufficient tenacity to resist slight attempts to tear or scrape it off.

Even the softer kind, which can be washed off, leaves behind a sort of thin foundation layer which requires some degree of force to separate it from the surface of the mucous membrane. The granular specks are usually much more intimately attached than the patches. On digesting the morbid material in liquor potassæ, and submitting it to microscopical examination, it is generally seen to consist of the spores and filaments of the *oïdium albicans*, with fat-globules, epithelial cells, and granular *débris*. Zenker has also found pus-cells in the epithelium. The fungus itself consists of cylindrical highly-refracting filaments, composed of long cells connected together, which contain granules and terminate in spores and spore-cells ; the latter are round or oval, generally adherent to each other, and, like the filaments, often contain granules.

The œsophageal fungus, according to Wagner,[4] is at first situated on the level surface of the epithelium ; this, however, soon becomes depressed by the penetration of the filaments, which sometimes strike so deeply as to drive in the walls of the blood-vessels of the *submucosa*. Parrot[5] states that in some instances the fungus nearly reaches the muscular coat. The rough pathological distinction between the false membrane of diphtheria and thrush consists in the fact that the former frequently attains a dense cohesion, thick wash-leather-like tissue being produced, while the thrush-exudation, though sometimes thick enough to narrow materially the lumen

[1] Op. cit., p. 214. [2] Op. cit., p. 113. [3] Loc. cit.
[4] Manual of General Pathology, transl. by Van Duyn and Seguin, London, 1876, p. 99. [5] Op. cit.

of the œsophagus, is merely a pulpy mass of aggregated particles. The microscopic characters of diphtheria have already been described (vol. i., p. 110 et seq.).

Diagnosis.—It is impossible to diagnosis the disease with certainty during life, but where there is evident difficulty in swallowing, and the vomited matters contain *oïdium albicans*, there can be little doubt that thrush is present in the œsophagus.

Prognosis.—If it can be ascertained that the gullet is extensively involved, the prospects of the patient must be regarded as extremely unfavorable. In doubtful cases, if the thrush in the mouth becomes of a dark color, if the food be regurgitated, if there be much vomiting or diarrhœa, and if there be marked general wasting, an unfavorable opinion must be given. The presence or absence of enteritis is, however, probably the most important factor in prognosis. Few cases of thrush recover if there be inflammation of the bowels, while, on the other hand, in the absence of this complication, thrush is seldom a serious disorder.

Treatment.—The rules already laid down under Pharyngeal Thrush (vol. i., p. 88) should be carried out with even more assiduity.

DIPHTHERIA OF THE GULLET.

Diphtheria of the gullet is extremely rare, and when present has no special clinical significance. After death, however, the false membrane is sometimes found to have involved the œsophagus. Among the few writers who have published cases are—Bretonneau,[1] Ferrand,[2] Espagne,[3] West,[4] Seitz,[5] Steffen,[6] Ziemssen,[7] Trendelenburg,[8] and Laboulbène.[9] Greenhow[10] appears to have heard of cases occurring in the practice of others, but to have met with no examples himself. Squire[11] mentions the occurrence of the œsophageal affection in two instances out of a tabulated list[12] of seventy-four cases of general diphtheria, but this probably represents an unusually large proportion. In their more important works neither Trousseau nor Oertel gives any example of œsophageal diphtheria, while Empis points out that its non-occurrence in the œsophagus is one of the essential points of distinction between diphtheria and thrush, which so often attacks the gullet. In two of Bretonneau's cases the disease extended to the gullet. In the first, which occurred in a weakly boy, aged fifteen, it reached, in the form of long bands, to the cardiac extremity of the tube, leaving the intervening portions of the mucous membrane healthy; while in the second, in which the patient was an infant eight months old, the exudation formed a continuous loosely-adherent coating. Ferrand has reported two cases in which the disease was secondary to

[1] Memoirs on Diphtheria, Syd. Soc. Transl., 1859, pp. 17, 18, 77, etc.
[2] De l'Angine Membraneuse, Paris, 1827, pp. 17, 20.
[3] De la Diphthérite, Montpellier, 1860, p. 107.
[4] Diseases of Infancy and Childhood, London 1874, sixth edition, p. 426.
[5] Diphtherie und Croup, von Dr. F. Seitz, Berlin, 1877, p. 349.
[6] Jahrb. für Kinderheilk., 1869, Bd. ii., p. 143.
[7] Cyclopædia. vol. viii., p. 145.
[8] First published in Petit's Traité de la Gastrostomie, Paris, 1879, p. 261 et seq.
[9] Nouveaux Elém. d'Anat. Pathol., Paris, 1879, p. 85.
[10] Diphtheria, London, 1860, p. 184.
[11] Reynolds' System of Medicine, 1866, vol. i., p. 399.
[12] This list is given in the Brit. Med. Journ., 1859, p. 305 et seq.

scarlatina. The false membrane extended deeply into the air-passages, and the upper part of the œsophagus was invaded. Laboulbène states that he has met with three cases. In one of them the membrane, which appeared to have extended from the pharynx, was of slight consistence, and did not lie on an ulcerated surface. Seitz has reported one instance in which a thin membranous exudation, covered with pus, extended 4 ctm. down the œsophagus. Steffen[1] has reported no less than fifteen examples, nearly all of which were complicated with one or more of the following conditions, viz., pneumonia, tubercle, chronic peritonitis, intestinal catarrh, follicular enteritis, caseation of the bronchial glands. In one instance there was a splenic abscess. Of the four cases in which the diphtheritic membrane was confined to the œsophagus, in one there were also extensive noma and chronic miliary tubercle of the lungs; in another there were chronic peritonitis, circumscribed pneumonia, and splenic abscess; in a third there were œdema of the lungs and intestinal catarrh; and in the fourth there were pneumonia, catarrhal inflammation of the epiglottis, and an ulcer at the lower part of the gullet.

I have myself seen two cases of diphtheria of the gullet, one in a child aged three, in which the upper third of the œsophagus was covered with a thick adherent membrane, a similar deposit being present in the pharynx. My other case was that of a boy, aged six, whose pharynx, posterior nares, larynx, and trachea were covered with false membrane, while the whole of the œsophagus to within an inch of the cardia was similarly coated.

The nature and treatment of diphtheria have already (vol. i., pp. 83–136) been so fully discussed that they need not be again referred to here.

MALIGNANT TUMORS OF THE GULLET.

Under this head are included (1) *Carcinomata and* (2) *Sarcomata.*

CANCER OF THE GULLET.

Latin Eq.—Carcinoma œsophagi.
French Eq.—Cancer de l'œsophage.
German Eq.—Krebs der Speiseröhre.
Italian Eq.—Cancro del esofago.

Definition.—Cancerous growth in the walls of the gullet, generally undergoing ulceration, but giving rise at the same time to great narrowing of the canal, often to perforation of the trachea or bronchi, and in rare instances to penetration of one of the large blood-vessels. In nearly all cases extreme dysphagia and marasmus are present.

History.—From the fact that the earlier writers did not attempt to separate malignant from non-malignant growths there is considerable difficulty in giving an accurate historical sketch of cancer of the œsophagus. Inasmuch, however, as benign growths are exceedingly rare in this situation, in doubtful cases it has been assumed that the writers have referred to malignant tumors.

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[1] Loc. cit. See page 46, note 3, respecting these cases.

In the second century Galen [1] speaks of fleshy growths completely or partially obstructing the œsophagus. In the tenth century Avicenna,[2] in describing the various conditions giving rise to dysphagia, mentions tumors as a frequent cause. Fernel,[3] who flourished in the sixteenth century, relates the case of a woman who died in consequence of her gullet being blocked up, close to its cardiac extremity, by a large hard mass, which prevented any food passing into her stomach for two months before her death. Coiter,[4] who lived somewhat later, mentions an interesting case of a woman who died after having suffered from dysphagia for eight years. After death a "scirrhous tumor of the size of a man's fist was found obstructing the lower end of the gullet." In Bonnet's [5] large collection of post-mortem records there are several cases of growths connected with the œsophagus, which had destroyed the patient by rendering swallowing impossible. An excellent account of various forms of œsophageal obstruction was given by Beutel.[6] Boerhaave and his pupil and commentator, Van Swieten,[7] were familiar with cancer of the gullet, and to the latter is due a remarkably vivid description of the sufferings endured by the victims of this disease. The subject did not escape the attention of Morgagni,[8] who, besides commenting on the cases of Bonnet and others, mentions one or two occurring in his own experience. Lieutaud [9] gives several examples, chiefly collected from the writings of other observers. Sir Everard Home [10] relates many cases of œsophageal stricture, some of them undoubtedly malignant. Baillie [11] referred to the subject in his work on pathology, giving also some excellent engravings [12] of œsophageal tumors, and soon afterward Monro *tertius* [13] published some additional cases. Subsequently Bell,[14] Howship,[15] and Mondière [16] recorded examples of the disease, and described its features in some detail. Since then, numerous cases have been published in the medical journals, and in the transactions of the various medical societies, while the subject has been more or less fully treated by Walshe,[17] Lebert,[18] Follin,[19] Béhier,[20] Zenker and Ziemssen,[21] Luton,[22] König,[23] and Butlin.[24]

Etiology.—Though cancer of the gullet may be regarded as the typical disease of that organ—the affection with which most practitioners are best acquainted—it is not relatively common. According to Zenker and Ziemssen,[25] in 5,079 autopsies, primary cancer of the gullet was present only 13

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[1] De symptomatum causis, lib. iii., c. ii.

[2] Canon, lib. iii., feu 13, tract. i., cap. iv. et v.

[3] De morbis univers. et particular. Libri quatuor posteriores pathologiæ. Lib. vi., cap. i., p. 125. Trajecti ad Rhenum, 1656.

[4] Observ. Anatom. Chir., p. 121.

[5] Sepulchretum, Genevæ, 1700, lib. iii., sect. iv., obs. ii.

[6] De strumâ œsophagi. Tübingen, 1742.

[7] Comment. in H. Boerhaave aphorismos, Lugdun. Batavorum, 1745, t. ii., § 797, p. 644 et seq.

[8] Epist. anat. med. de sedibus et causis morborum, Lugdun. Batavorum, 1767, ep. xxviii., sect. 14, 15, 16, t. iii., p. 12 et seq.

[9] Hist. Anat. Med., Parisiis, 1767, t. ii., p. 305 et seq.

[10] Pract. Observ. on the Treatment of Strictures in the Urethra and the Œsophagus, 1805, third edition, vol. i., p. 537 et seq.

[11] Pathological Anatomy. London, 1802.

[12] Engravings to illustrate Morbid Anatomy, London, 1872, tab. ii., fasc. iii.

[13] Morbid Anatomy of the Human Gullet, etc. Edinburgh, 1811.

[14] Surgical Observations, London, 1817, vol. i., p. 76 et seq.

[15] Practical Remarks upon Indigestion, etc., London, 1825, p. 161 et seq.

[16] Arch. Gén. de Méd., 1833, 2 série, t. iii.

[17] On the Nature of Cancer. London, 1846.

[18] Traité des Maladies Cancéreuses, Paris, 1851, p. 442 et seq.

[19] Sur les Rétrécissements de l'Œsophage, Paris, 1853, p. 49 et seq.

[20] Conférences de Clinique Médicale, Paris, 1864, p. 57 et seq.

[21] Cyclopædia of Pract. Medicine, London, 1877, vol. viii., p. 172 et seq.

[22] Nouveau Dictionnaire de Médecin et de Chirurgie, Paris, 1877, t. xxiv., p. 384 et seq.

[23] Deutsche Chirurgie, von Billroth and Lücke, Krankheiten des Pharynx und Œsophagus, Stuttgart, 1880, p. 68 et seq.

[24] Sarcoma and Carcinoma, London, 1882, p. 159 et seq.

[25] Cyclopædia, vol. viii., p. 173.

times. Concerning the relative liability to cancer of the œsophagus, as compared with other organs, there is less positive evidence. Dr. Walshe[1] states that 13 out of 8,289 deaths from malignant disease in Paris were ascribed to cancer of the œsophagus. In a table of 471 cases, the accuracy of which is vouched for by Lebert,[2] the gullet was the seat of the disease in 8 instances. The difference in the last two series is so great that at present the question must remain undecided. The same causes which predispose to or excite cancer in other parts of the body lead to its development in the œsophagus. Among the former are heredity, age, and sex; among the latter, continued local irritation, accidental injury, and chronic inflammation may probably be reckoned. Heredity appears to have considerable influence, for among 60 cases which I have examined with reference to this circumstance, some member of the patient's family had died from malignant disease in 11 instances, while among 10 cases observed by Richardson,[3] there was in no instance wanting a history of some malignant affection among the relatives. Age greatly influences the outbreak of the disease, which is extremely rare under forty. The greatest number of cases are met with between fifty and sixty, although the *decennia* immediately before and after that period furnish almost as many cases. In my 100 fatal cases the incidence of the disease in relation to age was as follows:[4]

TABLE 1.—*Author's Cases.*

Age.	No. of cases.
From 30 to 40	8
From 40 to 50	28
From 50 to 60	34
From 60 to 70	24
From 70 to 80	6
Total	100

The following table is an analysis of 30 cases occurring in the "Transactions of the Pathological Society."[5] It will be seen that the results closely correspond with my own cases:

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[1] Op. cit., p. 270. [2] Op. cit., p. 441.

[3] Trans. St. Andrew's Med. Grad. Assoc., 1872–73, vol. vi., p. 184.

[4] Of these 100 cases, 60 of the patients were under my own care, 23 having been treated by me in private practice, 28 at the Throat Hospital, and 9 at the London Hospital; 25 were treated by my colleagues at the Throat Hospital, and 15 by my colleagues at the London Hospital. These cases all occurred before the year 1875, when I published some lectures on the subject in the Medical Times and Gazette. My *clinical* experience is based on a far larger number of cases, but patients suffering from cancer of the gullet seek a great variety of medical advice, and cases which have been treated up to within a few weeks of their death are often finally lost sight of. My published statistics being based on 100 cases, I have not thought it worth while to introduce fresh figures by adding those I have met with since 1875.

[5] There are in all forty nominal cases reported in the Transactions up to the end of the session, 1874–75, but some of them do not appear to have been true cases of cancer, others are incomplete, and a few, having been reported by myself or my colleagues, are included in my own series.

TABLE 2.—*Cases from "Transactions of the Pathological Society."*

Age.	No. of cases.	Percentage.
From 30 to 40	2	6.66
From 40 to 50	6	20.
From 50 to 60	11	36.66
From 60 to 70	8	26.66
From 70 to 80	2	6.66
Over 80	1	3.33
Total	30	

The following is an analysis of 43 cases observed by Béhier,[1] but it is right to remark that in 3 of the cases occurring between twenty and forty the diagnosis was doubtful:

TABLE 3.—*Béhier's Cases.*

Age.	No. of cases.
From 20 to 30	3
From 30 to 40	4
From 40 to 50	10
From 50 to 60	11
From 60 to 70	10
From 70 to 80	3
At 82	1
At 86	1
Total	43

The following table gives the result of 58 cases collected by Mr. Butlin:[2]

TABLE 4.—*Butlin's Cases.*

Age.	No. of cases.
From 30 to 40	8
From 40 to 50	13
From 50 to 60	24
From 60 to 70	11
From 70 to 80	1
Over 80	1
Total	58

It may be remarked, however, that if the various tables were corrected in accordance with the number of people living at each decennial period, they would show a constantly increasing mortality from the disease as age advances.

Men are much more liable to the disease than women, a fact which is very distinctly borne out by my own series of 100 cases, of which 71 were

[1] Conférences de Clinique Médicale, Paris, 1864, p. 119 et seq.

[2] Mr. Butlin gives a list comprising fifty-nine cases, but in one of these the age of the patient is not stated.

of the male, and only 29 of the female sex. Habershon[1] gives a table of "85 cases collected from 'Guy's Hospital Post-mortem Records,' the 'Pathological Society's Transactions,' and other sources," of which 59 were men and 26 women. In Petri's[2] cases examined at the Pathological Institute at Berlin, the liability of the male sex to the disease is even more remarkable, for out of 44 cases, in only 3 were women the subjects of the disease. Ziemssen[3] reports 18 cases, among which there was but 1 female, but the diagnosis was not verified in every instance. Zenker[4] met with 15 cases of the disease, of which 11 were men and 4 women. While, however, men are more frequently attacked than women, the latter suffer at an earlier age. Thus, in Table 1, all the patients under forty years of age were women, three of them having been thirty-four, and the rest older. The average age of the men in my series was 52.43, and that of the women 44.5, while in Habershon's cases the average age of the men was 55½, and that of the women 44½, the latter average tallying exactly with mine. The greater predisposition of the male sex to cancer of the œsophagus is remarkable when it is recollected that more than twice as many women as men die of malignant disease, and that cancer of the contiguous viscus—the stomach—which in its liability to irritation is exposed to the same conditions as the gullet, is equally common in both sexes.[5]

The tubercular diathesis, which is ordinarily regarded as antagonistic to cancer in general, has been thought, on the contrary, by Lebert,[6] Hamburger,[7] and Fritsche[8] to predispose to that disease in the gullet. Lebert observed the coexistence of pulmonary tubercle with cancer of the œsophagus in seven out of nine cases, while Béhier[9] insists on the frequent coincidence of the two affections. The general experience of the profession points to an opposite conclusion, and considering the frequency of tubercle, the two diseases cannot be said to coexist frequently. Petri[10] found only 4 examples in his 44 cases, while out of 100 examples I only met with 3, in all of which the pulmonary disease showed signs of retrograde change.

Among local causes, the abuse of spirits has, since the time of Gyser,[11] been looked upon as an important factor in the production of œsophageal cancer, and the greater prevalence of the disease among men as compared with women has been attributed to this cause. Out of my own 60 cases only 5 acknowledged to have been free drinkers, and 6 others were publicans by occupation. It is quite possible that the abuse of spirits may predispose in several ways to the development of cancer in the gullet. Thus, by lowering the tone of the nervous system and causing degeneration of tissue, it may render all the organs less capable of resisting the constitutional taint. There does not, however, exist any decisive evidence on this point. Again, alcohol may directly irritate the mucous membrane or indirectly produce a similar result by causing eructations and vomiting.

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[1] On Diseases of the Abdomen, 1878, third edition, p. 84.

[2] Ueber 44 im Pathologischen Institut in Berlin in der Zeit von 1859 bis zum März 1868 vorgekommene Falle von Krebs der Speiseröhre. Berlin, 1868.

[3] Ziemssen's Cyclopædia, vol. viii., p. 193.

[4] Ibid., vol. viii., p. 186.

[5] Excluding cancer of the sexual organs, which is disproportionately frequent in woman, malignant disease affects both sexes in an almost equal ratio. This makes the greatly more common occurrence of cancer of the gullet in men all the more remarkable.

[6] Op. cit., p. 445.

[7] Klinik d. Œsophaguskrankheiten. Erlangen, 1871.

[8] Ueber d. Krebs d. Speiseröhre. Berlin, 1872.

[9] Op. cit.

[10] Loc. cit.

[11] De fame lethali ex callosâ œsophagi angustiâ, Argentorati, 1770, sect. vi.

Further, when people are half intoxicated, they are apt to be careless as to what and how they eat, and under these circumstances pieces of meat or foreign bodies accidentally introduced into the food are more likely to be swallowed, and thus to set up irritation. My own impression, on the whole, is that the effect of excessive indulgence in alcohol has been overrated in considering the etiology of œsophageal cancer.

The accidents which arise from taking too large or too hot morsels of food deserve a passing notice. Nearly a century and a half ago Van Swieten [1] was disposed to attribute the origin of the disease to swallowing very hot fluids, especially coffee, which at that time was coming into general use. This view, however, was no doubt erroneous, and was strongly opposed by Morgagni.[2] It is only when an excessively hot morsel has been swallowed that it can give rise to active symptoms. It is possible, also, that hot liquids may in some cases have caused an ulcer which has subsequently contracted in healing, and that the disease afterward met with, though mistaken for cancer, was not really of a malignant character.[3]

Sometimes the supposed cause, such as a foreign body sticking in the throat, is only the first symptom of the malady, but there appear to be other cases, such as those of Henoch [4] and Fritsche,[5] in which the swallowing of a very hot morsel of food seems to have determined the *site* of the growth.

In addition to other causes of œsophageal cancer the irritation set up by indigestion, with its attendant troubles, eructations and vomiting, must be mentioned. These have been already referred to as resulting from the abuse of alcohol; but of course they may arise from other causes.

In three cases that have come under my notice the patients suffered from vomiting for many years before any dysphagia was observed, and it is quite possible that in these instances the retching excited the development of cancer in the gullet. It is worthy of note that none of these patients were addicted to the use of alcohol.

Cancer may supervene on *simple stenosis*, as in a case reported by Dr. Hilton Fagge;[6] and I have met with several instances in which slight chronic inflammation having existed for many years, cancer ultimately showed itself. The following is a good illustration, but others equally remarkable have come under my observation. A poor woman, aged forty-five, consulted me in 1863, on account of dysphagia. A bougie could be passed with ease, and as the patient was of very nervous temperament I treated her with valerianate of zinc and similar remedies. She frequently consulted me, and for some years I regarded her case as "functional;" judged of, however, by the light of others which I have since met with, I feel sure that the symptoms were due to chronic inflammation of the œsophagus. In the early part of 1874 a cancerous growth was seen with the mirror protruding from the orifice of the œsophagus, and by the end of the year the patient died from extensive epithelioma of the gullet. It appears more probable that the cancer originated as a spot chronically inflamed than that malignant disease existed all the time, but was completely

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[1] Op. cit., t. ii., pp. 647, 648.

[2] Op. cit., § 797, ep. xxviii., art. 15, t. iii., p. 15.

[3] As in a case reported by Leroux. Cours sur les généralités de la Médecine Pratique, Paris, 1825, t. i., p. 315.

[4] Casper's Wochenschr. f. d. gesammte Heilk., 1847, No. 39.

[5] Op. cit., p. 74. These cases are quoted by Zenker and Ziemssen, who also refer to another case by Deininger, which, however, does not appear to me to be so conclusive.

[6] Guy's Hospital Reports, series 3, vol. xvii.

masked, and progressed so slowly that it did not terminate fatally for ten years.

The frequency with which cancerous growths originate in cicatrices in other parts of the body makes it probable that they sometimes have a similar starting-point in the œsophagus. Neumann[1] has recorded what appears to be an example of this mode of origin, and Ziemssen[2] has met with another which might bear a like interpretation. From the analogy of the tongue, where it is a matter of common observation that syphilitic ulceration is prone to take on a carcinomatous character, it may justly be inferred that scars left by old venereal mischief in the gullet may become the site of malignant disease.

Symptoms.—The most constant, striking, and important phenomenon is difficulty in swallowing. It is this which usually first attracts and then rivets the sufferer's attention. The train of symptoms is generally somewhat as follows: The patient first experiences an occasional obstruction to the descent of food, if he takes a large mouthful, or if the food is of a dry nature. In a short time this difficulty becomes habitual, and the patient complains that food lodges somewhere—usually at the same point—when he tries to swallow. He now often begins to be troubled with cough, especially when deglutition is attempted, and as the disease progresses he is obliged to wash down every mouthful with a draught of liquid, and he soon finds that he cannot take solids at all, except after prolonged mastication and with the aid of fluids. Then he is no longer able to swallow solid food in any form, his diet is restricted to liquids, and he loses flesh rapidly. As time goes on in some cases the stricture becomes so narrow that even liquids cannot be got down, or a fistulous opening being formed between the œsophagus and trachea, the swallowed liquids pass into the windpipe and are immediately ejected by a violent and painful attack of coughing. As soon as the gullet becomes much contracted the patient begins to spit up a frothy fluid, which is at first clear, and closely resembles saliva, but which soon becomes viscid or muco-purulent, and is not unfrequently streaked with blood. Sometimes small particles are voided, which, on microscopic examination, are found to be of cancerous nature. Emaciation rapidly advances, and the patient soon becomes greatly wasted, and so weak that he is unable to take any exercise, or indeed to perform any act requiring muscular effort. The cancerous cachexia is often absent, the patient dying of starvation before the constitution becomes markedly perverted.

On analyzing the symptoms it will be found that there is not one which may not be occasionally absent, and that the mode of their occurrence varies in particular cases. Dysphagia is the most constant symptom, but there is at least one case on record[3] where it was not present. The patient generally states that the food is arrested at the upper part of the gullet, even in those cases where subsequent post-mortem evidence shows that the stricture was situated quite low down, a circumstance probably to be explained by the occurrence of reflex spasm. Though the dysphagia generally comes on gradually, it sometimes arises quite suddenly. I do not refer here to those cases in which the patient having swallowed too large or too hot a mouthful, the symptoms have developed from that date, but to those rare instances of which the following, recently under my notice, may be taken as an illustration:

[1] Virchow's Archiv, Bd. xx., p. 142.
[2] Cyclopædia of Medicine, vol. viii., p. 188.
[3] Trans. Path. Soc., vol. vii., p. 188.

E. Y., aged fifty-six, was in perfect health, as far as he was aware, until a certain day when at dinner. After eating a few mouthfuls a piece of meat stuck in his throat, and he had to leave the table and eject it. He returned to his dinner, but could not swallow any food, though he was able to drink beer. In the evening he tried some supper, but found he could not swallow solids; and from that day till his death, seven months afterward, he was never able to take a morsel of solid food.

As has been already shown, dysphagia begins with a difficulty in swallowing solids, and the patient is soon obliged to depend entirely on liquids. In swallowing these he makes a loud gurgling noise, which is audible to himself, and even to those standing near. At first he drinks easily, but after a little time he finds that the fluids will only pass very slowly down the gullet, and if he is not very careful, the drink will be suddenly and violently ejected through the mouth and nose. Occasionally a portion of the drink or semi-solid substance may be retained for a few minutes and then vomited, but the alkaline character of the *ejecta* shows that they come from the œsophagus and not from the stomach.

Patients *in extremis*, previously almost unable to swallow liquids, may suddenly regain their power of taking semi-solid food for a short time before death, but such improvements are illusory, and may probably be explained by the sloughing away of a portion of the growth, or by diminution of spasm from increasing muscular debility. The act of degeneration is very seldom painful, but there is sometimes a dull aching sensation, which, if present, is generally aggravated on swallowing. The pain is occasionally referred to a definite spot, which corresponds with the point where the food seems to lodge. At other times it is felt between the shoulders, behind the sternum, at the epigastrium, or more rarely in one of the ears. The pain is often slight, amounting to little more than uneasiness, and it is only in rare cases that it is described as sharp, cutting, or burning. The suffering is, as a rule, more keenly felt at night, and sometimes it is sufficiently severe to keep the patient from sleeping.

Here it may be mentioned as a curious circumstance that a darting pain between the shoulders—occurring independently of deglutition, and not increased by that act—is occasionally the first symptom of cancer of the gullet. I have met with two instances in which this symptom preceded dysphagia by more than three months.[1]

The digestion becomes greatly impaired. Milk or eggs sometimes remain in the stomach for four or five hours without undergoing any appreciable change. Positive evidence of this can often be obtained on examination of the vomit of patients after the passage of bougies for the purpose of dilatation. In order to lessen the chance of inducing sickness I always direct the patient to abstain from food for some hours before the instrument is to be used, but in spite of this precaution, the contents of the stomach are occasionally brought up, and I have not unfrequently remarked that they have scarcely been acted on by the gastric juice. Independently of the use of instruments, however, real gastric vomiting occasionally takes place, and when the disease is advanced this is a very distressing symptom. For the stricture appears to become tightened at the moment of vomiting, and entirely prevents the ejection of matters from the stomach, while repeated fruitless contractions of the latter viscus often give rise to a feeling of weight and sometimes to a dull heavy pain in the epigastrium. The patient is also further tormented in some in-

[1] Odynphagia preceded dysphagia in a case of malignant disease of the œsophagus reported by Cooper Forster (Guy's Hosp. Reports, 1858, third series, vol. iv., p. 1 et seq.), and in another by Sydney Jones (Trans. Path. Soc., 1860, vol. ix., p. 101).

stances by the impossibility of ridding himself by eructation of the gas which is formed in large quantities. As might be expected, the excretions become much diminished in quantity. The bowels frequently do not act for a week or ten days together, and the fæces are very hard; as a rule, very little urine is passed.

Hunger is sometimes complained of when the patient begins to be unable to swallow solids, but this soon passes off, and in an advanced stage of the disease the very thought of food is generally loathsome. When the canal is nearly closed up the patient's sufferings are aggravated by dryness of the throat and intense thirst, which generally persist till within a few hours of death. Should there be much ulceration (and especially when the disease affects the upper part of the throat) the breath has often a faint or fetid odor, while if gangrene comes on the smell is horribly offensive.

Cough is of frequent occurrence, and is generally due to slight chronic laryngitis, which commonly accompanies stricture of the œsophagus. The affection of the windpipe may occur as an extension of the cancer, or it may be caused by the passage of food or the overflow of saliva into the larynx. If a fistulous communication has been established between the œsophagus and the trachea or bronchi, the coughing is of a very violent kind, and is called forth whenever swallowing is attempted. Dysphonia is not unfrequent. It may be caused by slight inflammation of the larynx, or by paralysis of a vocal cord from implication of one of the recurrent nerves in the disease. For obvious anatomical reasons (see vol. i., Fig. 90) the left nerve is much more frequently affected than the right. When the latter is paralyzed, it usually indicates that the cancer is situated in the upper part of the throat. There may even be some dyspnœa or stridor, when, as generally happens in the early stage of nerve-pressure, it is the abductor muscle which is mainly affected. The laryngeal symptoms are of course greatly intensified when both abductors are involved (see vol. i., p. 251, Case 3).

In an advanced stage of the malady, the growth may press directly on the windpipe posteriorly, and thus give rise to severe dyspnœa. There are seldom any external signs of the disease, but when the upper third of the gullet is affected, careful examination will sometimes detect a slight thickening in the neck, some distance below the surface, and in rare cases the deep cervical glands can be perceived to be enlarged. Still less frequently the superficial glands are enlarged and tender. On introducing the œsophagoscope, the situation and character of the disease can sometimes be made out, but its extent cannot be ascertained.

On auscultating the gullet the site of the disease can generally be determined. At the commencement of the affection, the "bolus" may be merely delayed, or irregularly forced down, but temporary arrest in its descent can generally be observed at a very early period. As the disorder gains ground the acoustic signs become more marked. Instead of the sound of a small fluid body rapidly passing beneath the stethoscope, a prolonged and confused gurgling noise is heard over the diseased spot, and a little above it. Below this point deglutition is scarcely audible.

The bougie, as a rule, furnishes very precise information if it be carefully used while the patient is fully under the influence of an anæsthetic. On the other hand, the knowledge obtained by means of this instrument while the patient retains consciousness is generally incomplete and often misleading. Chloroform is the best agent for the purpose, ether having an irritating effect in these cases, and nitrous oxide being too transient in

its action. On attempting to pass a bougie, it will be found that the progress of the instrument is completely arrested at a certain spot, or that it can only be passed with difficulty through a constricted opening. Sometimes after the bougie has penetrated one stricture it encounters a second, the two obstructions generally corresponding to the upper and lower edges of a single ulcer, but in rare cases being caused by two separate growths.[1] However gently the instrument may be used, its point will sometimes be found to be smeared with blood, and the patient may spit up a few drops, or even a drachm or two, of blood directly after the operation.

The local phenomena and physical signs of the disease having been discussed in some detail, it is necessary to make a few further remarks on the general symptoms exhibited by the patient. These are progressive emaciation, extreme muscular debility, and intense faintness.

The weight of the patient gradually but steadily diminishes. Thus, one of my patients was reduced from twelve to five and a half stone in less than three months, and in another case five stone were lost in seven weeks.

But while emaciation almost invariably accompanies the malady, patients occasionally die from asthenia, while the nutrition is still almost unimpaired. As an example I may mention that in one of my patients, on whom Mr. Heath performed gastrostomy after nine days' total privation of food, the fat in the abdominal walls was an inch in thickness, while the omentum was a mass of adipose tissue. In another case on which I recently made a post-mortem examination, though the disease had run an unusually long course, there was not a trace of wasting in any part of the body. All patients, however, experience a dreadful sense of faintness. While revising these pages I have received a letter from a patient in a very advanced stage of the complaint, in which the following passage occurs: "I do not think anything has passed down during the last forty-eight hours! My weakness rapidly increases, and I suffer from a *terrible faintness.* My flesh decreases daily, and my body has gone hollow." Except in very warm weather there is often a feeling of cold, not only in the extremities, but in the body generally.

Although the sufferings are very severe until within a day or two of the fatal termination, the last hours are generally quite placid, the patient retaining his faculties till very near the end, and passing away in a state of gradually deepening coma.

Death usually takes place from exhaustion, unless some complication should arise from the extension of the disease to neighboring organs. The most common form of this is perforation into the air-passages. In my 100 cases death resulted from exhaustion in 78, from pneumonia in 17, from acute pleurisy in 3, and from gangrene of the lungs in 2 instances.

The modifications in the symptoms, which are caused by the spread of the cancer in different directions, require a brief notice. As just remarked, the most common extension is into the air-passages, between which and the œsophagus a communication or *perforation*[2] is often established, but in

[1] See the cases of Sédillot (Gaz. Méd. de Strasbourg, 1853, p. 69); Poinsot (reported by Bidau, De l'Œsophagotomie, Bordeaux, 1881, p. 79); Golding Bird (Trans. Clin. Soc., 1882, vol. xv., p. 36); and Annandale (Liverpool Med.-Chir. Journ., July, 1881, p. 14).

[2] By some authors *perforations of the gullet*, from whatever cause arising, and whatever the nature of the communication established, are classified together and treated in a separate article, though the utility of such an arrangement is not obvious. The

rare cases a large vessel may be laid open by the ulcerative process. As the result of the invasion of neighboring parts by the growth, inflammation of many adjacent organs and tissues may occur, pericarditis, pleurisy, pneumonia, or even peritonitis being occasionally met with, while two cases are on record[1] in which paralysis of the lower extremities ensued from the disease at last reaching the spinal cord.

The signs of *perforation of the gullet* depend on the nature of the communication which is set up with the food-tract. Thus, simple *perforation into the peri-œsophageal connective tissue* leads to abscess, sloughing, and gangrene, but the symptoms are often so slight that they are not recognized during life. On the other hand, *perforation into the air-passages* produces such a characteristic train of symptoms that it is generally easily discovered. This is the most common form of perforation, and is especially to be feared in those cases in which there is frequent but not severe spitting of blood. Violent coughing and considerable dyspnœa when the patient attempts to swallow are the symptoms which show that the air-passage has been penetrated.[2]

Perforation of a large vessel is a rare termination of the disease, and did not occur once in my one hundred cases. Although there are numerous instances recorded in medical literature, it must not be forgotten that these cases are generally published on account of their comparative rarity, and that they exemplify the exception rather than the rule. If a large vessel be ruptured, violent hemorrhage comes on, to which the patient may succumb in a few seconds, or the bleeding may stop for some hours—but only to break out anew with a fatal result. The subject of perforation will be again referred to in dealing with the pathology.

Pathology.—There has been a growing tendency for some years past to consider that a very large proportion of cancers of the œsophagus are of epitheliomatous nature, and Zenker and Ziemssen[3] go so far as to state that this is the *only* form which is met with in this situation. This statement, however, is too absolute, for in the elaborate collection of cases of malignant disease made by Mr. Butlin,[4] three were undoubtedly scirrhous in character, while one certainly belonged to the medullary, and another to the colloid variety of carcinomata. The three instances of hard growth showed a well-marked alveolar structure, and their course was much more chronic than that of the epitheliomatous cases. The nature of the medullary tumor was determined by so high an authority as Dr. Joseph Coats,[5] of Glasgow, while the case of colloid cancer was reported on by the committee of the Pathological Society,[6] and may, therefore, be accepted as un-

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perforations produced by a malignant growth, an aneurism, or a foreign body, are totally different in their mode of development, in the symptoms they cause, and in their ultimate termination. Again, the widest difference exists, according as the perforation takes place into the air-passages, into a large vessel, or into the peri-œsophageal tissue. It is difficult, therefore, to discover what advantage can be derived from bringing together a set of accidents disagreeing in almost every particular.

[1] Mondière: Arch. Gén. de Méd., t. xxx., p. 515; and Zenker: Ziemssen's Cyclopædia, vol. viii., p. 180.

[2] According to Lebert (op. cit., p. 445), perforation of the air-passages does not always give rise to these symptoms, and it sometimes happens that the lesion is not suspected until the autopsy is made. This observation can only apply to very small perforations, or to those which have taken place only a short time before death.

[3] Cyclopædia of Medicine, vol. viii., p. 173.

[4] Sarcoma and Carcinoma, London, 1882, pp. 177, 178. See also Tables, pp. 185–187.

[5] Glasgow Med. Jour., 1872, second series, vol. iv., p. 402.

[6] Trans. Path. Soc., 1868, vol. xix., p. 228.

doubtedly genuine. It presented a honey-combed structure, and contained a viscid material. The opinion, however, seems to be now pretty generally entertained by pathologists that the appearances which sometimes resemble scirrhous or encephaloid cancer depend on the varying degrees of density in the structure of the stroma, or on degenerative changes which may have taken place in the morbid tissues themselves. The disease is usually supposed to commence in the deeper layers of the *mucosa*, but in some cases it appears to be developed from the epithelial lining of the follicles.

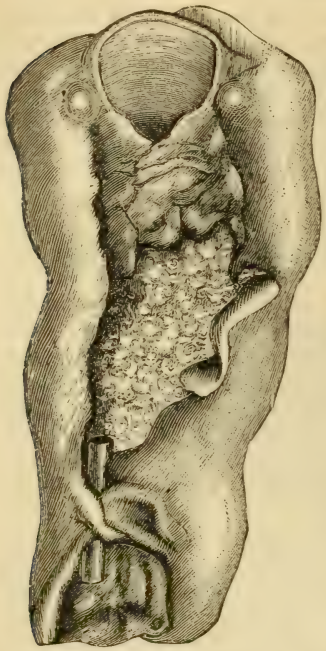

FIG. 13.—Malignant Disease of the Gullet. At the narrowest part only the fine glass rod, shown in the cut, could be passed through the stricture. (From a specimen in the Museum of the Throat Hospital.)

If the œsophagus could be exposed to view at a very early date the disease would probably present itself in the form of one or more small isolated patches; but by the time death takes place, it has generally involved the whole circumference of the gullet, and extended for three or four inches in the vertical direction. Sometimes, however, even when the patient has died from dysphagia, it is found after death that the growth occupies only one side of the œsophageal canal. The surface of the tumor is more or less irregular, and is generally extensively and deeply ulcerated. Among Butlin's fifty-three cases ulceration had taken place in forty-nine. The ulcer has, as a rule, a foul, sanious base and a raised, thickened everted edge. It can generally be perceived that the stricture which has existed during life has been caused by masses of growth projecting into the canal, or by general thickening of the walls, or by the out-turned edges of the ulcer diminishing the œsophageal lumen. This last cause is principally in operation at the upper and lower borders of an ulcerated surface, and hence observers have sometimes been led to imagine that there were two growths, each causing a stricture in the canal, when, in point of fact, there was only one tumor.[1] When the mass is cut into, the section is of a grayish-white or occasionally of a brownish-red color, and when squeezed, yields a milky juice. On microscopic examination this fluid is found to consist of aggregated and distinct epithelial cells, and the growth is seen to be made up of a stroma of fibrillated tissue, arranged so as to form alveoli of various shapes and sizes, within which flat epithelial cells are found. Some of these bodies are grouped together so as to produce concentric globes, which, on being cut through, present the well-known form of nested cells. The epithelial elements may be seen making their way into the tissues around the ulcer, and beyond these again will be found an infiltration of small round corpuscles (indifferent cells).

There is considerable difference of opinion as regards the part of the gullet most frequently attacked. Sir Everard Home[2] says: "There is this

[1] See a case reported by Motta, Gazette Médicale, 1873.
[2] Op. cit., vol. ii., p. 395.

one spot immediately behind the cricoid cartilage where the fauces may be said to terminate and the œsophagus to begin, in which such a contraction is so often met with, that I must consider it as more liable to become diseased than the rest of the canal." Rokitansky [1] affirms that the upper half of the gullet is most often the seat of the disease, and Habershon's experience and my own point to the same conclusion. Klebs [2] and Rindfleisch [3] find the middle portion most frequently affected, while Petri [4] and Zenker and Ziemssen [5] have observed that the lower third furnishes the greatest number of cases. The following tables show these various results :

MACKENZIE.		HABERSHON.	
Upper third	44	Upper part	33
Middle "	28	Middle "	30
Lower "	22	Lower "	10
Lower half	6		
	100		73

PETRI.		ZENKER.	
Upper third	2	Upper third	2
Middle "	13	Middle "	1
Lower "	18	Lower "	6
Upper and middle thirds	1	Upper and middle thirds	2
Middle and lower "	8	Lower and middle "	3
Whole canal	1	Whole canal	1
	43		15

Mr. Butlin [6] states that in his series of fifty-nine cases, "in by far the larger number of instances, the disease occurred in the upper than in the middle or lower thirds," but "the point of junction of the middle and lower thirds was three times more often attacked than that between the two upper thirds ; so that if the canal be divided into halves instead of thirds, the number of cases affecting each half is very nearly equal."

As the result of *clinical* examination, Ziemssen [7] has found the disease situated in the lower third of the gullet in thirteen cases out of eighteen. The great discrepancy between the different tables may, perhaps, be explained by the fact of some pathologists having excluded cases of cancer of the upper part of the œsophagus in which the pharynx was also implicated. As has already been pointed out (p. 1), the line of demarcation between the pharynx and the gullet is arbitrary, some anatomists fixing the *lower border of the cricoid cartilage* as the point of separation, while others take the *cricoid generally* as the boundary line. A cancer of the food-tract behind the cricoid is relatively very common, it makes a great difference whether this situation be included in the pharynx and excluded from the œsophagus in statistical tables. Further, as Mr. But-

[1] Oesterr. medicin. Jahrb., 1840, Bd. xxi., p. 225.
[2] Handbuch d. pathol. Anatomie, 1868.
[3] Pathol. Histology, Syd. Soc. Transl., 1872, p. 457.
[4] Loc. cit.
[5] Op. cit., p. 176.
[6] Sarcoma and Carcinoma, London, 1882, p. 162.
[7] Op. cit., p. 193.

lin[1] observes, when the disease is widespread, the difficulty of determining its primary point of invasion impairs the accuracy of all calculation as regards the part of the œsophagus most frequently affected.

As König[2] has remarked, the situation of cancer of the œsophagus is a matter of some practical importance, for if the growth is at the lower part, gastrostomy is the only palliative operation that is justifiable.

Cancer of the œsophagus is sometimes confined to that tube, but observation shows that it spreads both by continuous extension and by secondary deposit. In my 100 cases the deep cervical glands were alone attacked in 14 cases (in conjunction with other glands in 3 other cases, and in conjunction with other organs in 4 cases); in 2 cases one lung was involved, in 1 case the liver, and in 1 the liver and one lung were implicated, while the left kidney, stomach, and tongue were each once affected. Out of 44 cases of cancer in the upper third, in 12 the disease at the same time involved the pharynx above the level of the arytenoid cartilages, and in 1 case the thyroid gland, while of 30 cases at the lower part of the œsophagus, in only 1 the disease reached the stomach. In 36 cases in which there was a broncho-œsophageal fistula, the tissues surrounding the opening were thickened in every instance, while in 13 there was distinct disease within the trachea. In 7 other cases in which perforation had not taken place, there were nodular elevations of the lining membrane of the tracheo-bronchial canal. In the whole series of 100 cases perforation of the air-passages took place 36 times, the trachea being perforated 20 times, the right bronchus 7, and the left bronchus 4 times, the base of the lungs in 2 instances, and the pleural cavity in 1, while twice the perforation took place into the peri-œsophageal tissues. In my 100 autopsies the left recurrent nerve was found to be involved 9 times, the right recurrent once, and in one instance both nerves were affected. It should, however, be remarked that all these 11 observations occurred among my own 60 patients (see foot-note 4, p. 51), and it may be presumed that if this matter had been carefully looked into in the other 40 cases, nerve-lesion would have been frequently met with.

Perforation of blood-vessels, according to Lebert,[3] is rare, while Rokitansky,[4] in expressing a somewhat similar opinion, asserts that the aorta and right pulmonary artery are the vessels which most frequently yield. In addition to these vessels, the carotid,[5] subclavian,[6] vertebral,[7] œsophageal,[8] and superior intercostal[9] arteries may be mentioned as having been thus perforated.

I have met with two cases (Specimens 101 and 200, Throat Hospital Museum) in which abscess was developed in connection with the diseased mass in the gullet, and a further example of a similar complication has lately been reported by Dr. Semon.[10]

Diagnosis.—Although under ordinary circumstances the recognition of cancer of the œsophagus is easy, cases of doubtful nature occasionally present themselves. It is important, therefore, to determine at once whether the dysphagia be due to an extrinsic or an intrinsic cause. Laryngoscopic examination enables the observer to discard disease either of the pharynx

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[1] Op. cit., p. 163.
[2] Deutsche Chirurgie von Billroth und Lücke, Krankheiten des Pharynx und Œsophagus, von Prof. König, Stuttgart, 1880, p. 69. [3] Op. cit., p. 444.
[4] Pathological Anatomy, Syd. Soc. Transl., London, 1854, vol. ii., p. 11.
[5] Lancet, February 14, 1860. [6] Trans. Path. Soc., vol. xxii., p. 134.
[7] Ibid., vol. ix., p. 194; vol. xii., p. 108. [8] Ibid., vol. xiv., p. 167.
[9] Ibid., vol. viii., p. 210. [10] Archives of Laryngology, 1882, vol. iii., p. 125.

or larynx as a possible factor, while the absence of swelling or tenderness in the neck will serve to eliminate most of the morbid conditions in that region which could give rise to compression of the gullet. When this is produced by deeply-seated tumors or abscesses, a bougie can be passed in most cases, but the pressure on the canal resulting from great enlargement, whether cancerous or fibroid, of the thyroid body, or from malignant deposit in the mediastinum, is sometimes sufficient to prevent the introduction of the finest instrument. In such instances, however, the external evidences and physical signs of the radical disease are generally obvious.

In aneurism of the aorta and in other affections of the circulatory system, there is seldom any difficulty in passing the œsophageal bougie, though force should on no account be used ; the physical signs of aneurism are also generally discernible by auscultation and percussion. When it has been established that the disease is intrinsic, it must next be decided whether the dysphagia be organic or functional.

Spasmodic stricture is far more common in women than in men, and usually occurs under the age of forty. The symptoms are suddenly, not progressively, developed as in cancer. There is no pain or regurgitation of frothy fluid, though the mouthful of solid or liquid food may be immediately and forcibly ejected. A bougie can always be passed, though sometimes this can only be effected under the influence of an anæsthetic. There is seldom any considerable wasting, but on the contrary, the patient, though weak, is often plump. Collateral evidence, such as a markedly emotional disposition, may assist in the diagnosis.

Paralysis of the œsophagus generally occurs in the old and feeble—that is, in people whose muscular system is weak, or in cases of chronic wasting disease. The dysphagia is seldom extreme, and the easy passage of a bougie at once shows the absence of true stricture.

Passing to organic lesions in *syphilitic disease* there may be a clear history of infection or the acknowledgment of former symptoms, such as a skin eruption, falling of the hair, nocturnal pains in the shin-bones or the scars of former ulceration, either on the skin or mucous membrane ; or coexistent disease of an undoubtedly syphilitic character, may remove all doubt as to whether the system has been infected. Of course, cancer may occur in syphilitic individuals ; but the curative effects of iodide of potassium in truly syphilitic cases, and the fact of its being virtually inoperative when cancer has been engrafted on syphilitic ulceration, will eliminate this source of difficulty. Narrowing of the canal, caused by *tubercular deposit*, being extraordinarily rare, and always secondary, requires only to be mentioned.

In *traumatic stricture* the history of the case explains its origin, but it may be added as a negative sign that in this class of cases the recurrent nerves are very seldom involved. In *chronic œsophagitis* the dysphagia is also much less marked than it is in carcinoma, and the inflammatory affection is not progressive. The food can, indeed, generally be swallowed, though with uneasiness, or even pain. On the other hand, the odynphagia is much more marked in chronic inflammation, and a bougie usually causes so much pain that it can only be passed under the influence of an anæsthetic.

In *simple dilatation* frequent regurgitation of unaltered food after a meal is a prominent symptom, and although there may be difficulty in passing a bougie, this can generally be overcome with perseverance.

Cancer of the pyloric orifice of the stomach is occasionally mistaken by

the inexperienced for malignant disease of the œsophagus; but in the former complaint the food is generally retained for an hour or two, and, when brought up, has a decidedly acid reaction. Lastly, the diagnosis may be assisted by a careful consideration of the symptoms, which, taken together, are characteristic of cancer of the œsophagus; these are *progressive* dysphagia, exspuition of a fluid, at first frothy, but afterward thick, muco-purulent, and sometimes tinged with blood, obstruction to the passage of a bougie, frequent paralysis of one, and occasional paralysis of both abductors of the vocal cords, with progressive emaciation and debility occurring in a person over forty years of age.

Prognosis.—The course of the disease tends steadily toward a fatal issue, the opinion of Rokitansky,[1] based on the frequent appearance of certain cicatrices in the œsophagus, that cancer in this situation is often cured, being opposed to all other experience. In my 100 cases, the average duration of life after undoubted symptoms were developed was only 8 months —the maximum being 16 months, and the minimum 5 weeks. Each case, however, must of course be judged on its own merits. We must take into consideration the age of the patient, his previous health, and especially his temperament—persons of nervous organization generally resisting the slow starvation much longer than the phlegmatic. The duration of life is, however, dependent on such purely accidental conditions that it is never safe to give an opinion as to how long it may be extended. The gullet, which has remained partially pervious for months, may be suddenly completely blocked, or a perforation may occur without any warning.

When a perforation into the air-passages takes place, the patient seldom survives more than three or four weeks—unless he can be fed with a tube, when life may still occasionally be prolonged for a few months. If a considerable hemorrhage occurs, and is arrested, its speedy recurrence must be looked for.

Apparent improvements are only of the most temporary character, and the recovery of the power of swallowing at a late period of the disease must not be regarded as a favorable symptom, but rather the reverse, indicating, as it usually does, sloughing of the growth or the mere giving way of spasm from increasing weakness.

Treatment.—In dealing with cancer of the œsophagus, we have no satisfactory task, but something may be done to prolong life and more to assuage suffering. Local treatment is rarely of any use, but when the disease is situated at the orifice of the gullet, the growth may sometimes be in part destroyed by electric cautery, or removed with cutting forceps. I have also seen benefit from insufflations of a powder composed of one part of persulphate of iron to three parts of starch. This astringent application causes some shrinking of the growth, and thereby widens the canal. This effect, however, is of course only mechanical and temporary. Directly there is a suspicion of malignant disease the food should be most carefully selected. Milk, on account of its highly nutritive and unirritating character, should be regarded as the staple article of diet, but beef-tea, mutton broth (free, of course, from pepper or salt), eggs, arrowroot, or thin, soft farinaceous food may be given; stimulants should, if possible, be avoided, as they irritate the diseased surface. It is important to determine the circumstances which justify the use of bougies, and also to appreciate the conditions under which the feeding-tube may be employed with advantage. In the first place, it must be distinctly stated that as long as the patients

[1] Lehrbuch d. path. Anatom, 1855, Bd. i., p. 278.

can swallow liquids easily, bougies should not be passed. When, however, fluid nourishment can only be got down with difficulty, and when that difficulty is steadily increasing, the time for instrumental interference has arrived, and the question arises whether an attempt shall be made merely to keep the œsophagus open, or whether the surgeon shall endeavor to enlarge the narrowing canal. At this period it will generally be found that only a No. 3, or at most a No. 4 (Author's scale, Fig. 2, p. 9) can be passed, but sometimes a No. 5 or a No. 6 can be got through. As a rule, the mere passage of a bougie from time to time is of little use, for it is found that progressively smaller sizes have to be employed, and that at the end of a few weeks no instrument will pass. Hence it is almost always desirable to attempt some dilatation. This should be done twice a week, and the surgeon must be satisfied if he can dilate to the extent of No. 8. If the passage of a bougie causes bleeding, instrumental treatment should be discontinued for a time. In any case, however, when dilatation has been practised for a few weeks, it is almost certain on one occasion or another to give rise to some inflammatory action within the gullet, and the patient may find that after the use of the instrument he is unable to swallow for many hours. After a few days' rest, however, liquids again pass, and mechanical treatment can be resumed.

In certain cases it may be possible to remove projecting portions of the growth, and so open a way for an œsophageal tube. By means of the œsophagoscope I was able on one occasion to carry out the line of treatment here suggested. The following are the details of the case:

Mrs. B., aged sixty-two, was sent to me by Mr. Yate, of Godalming, on June 28, 1880, on account of difficulty of swallowing, which had commenced two years previously. She was able to take liquids easily, but could not swallow solids. The dysphagia gradually increased, and at the beginning of August, Mrs. B. could take liquids only with the greatest difficulty. At last, even liquids could not be swallowed. With the œsophagoscope a ragged projecting mass was seen about three inches below the lower border of the cricoid cartilage. On August 18th, in the presence of Mr. Yate, Mr. Hovell, and Mr. Bailey (who administered chloroform), I succeeded in removing with the œsophageal forceps a piece of growth about the size of a cherry. The effect of the operation was most satisfactory. The patient felt some pain for two or three days, but a week after the operation she was able to swallow semi-solids with ease. Microscopic examination showed that the tumor was an epithelioma. Mrs. B. lived rather more than half a year after the operation, which may fairly be considered to have prolonged life for four or five months.

The œsophageal feeding-tube (Fig. 11, p. 17) may be used under two conditions: First, when the disease is complicated by spasm; and, secondly, when there is a broncho-œsophageal fistula. In cases of spasm it is only when the muscular contraction is of a very enduring character—that is, when it lasts for the greater part of the day—that the feeding-tube is required. Under these circumstances the patient should be placed fully under the influence of chloroform, and a pint of strong nutriment administered at least once in the twenty-four hours. When this process has been repeated for a few days the spasm often passes off, and the artificial feeding can then be discontinued.

It is, however, when a tracheo-œsophageal fistula has been established that the feeding-tube is of special service. The train of symptoms by which the existence of the fistula can be recognized has already been described (p. 59). If the opening between the two tubes is small, although liquids when swallowed will pass through the aperture and give rise to violent coughing and choking, the point of the instrument will often glide

over the orifice of the fistula, and thus allow the patient to be fed. When, however, the opening of the fistula is large, there is a risk of the feeding-tube passing through it into the windpipe. Hence it is very important not to use force in introducing the tube, and the operator should be quite certain that the feeding-tube has not found its way into a false passage before he injects any food. If the instrument has penetrated the windpipe some spasm is nearly sure to be set up, and the patient on coughing will force air through the tube, and thus demonstrate its position. In most cases of fistula, the feeding-tube should be used as long as the patient survives, but sometimes the tracheo-œsophageal opening increases in size after a few weeks, and the tube can no longer be passed with safety. When the patient is quite unable to swallow, either from complete closure of the gullet, or from the establishment of a large fistula, the time for using nutritive enemata commences. It is a mistake to begin this method of feeding as long as the patient can get down any considerable quantity of liquid food, as it may irritate the bowel prematurely, and thus prevent rectal alimentation when it might remain as a last resource. The patient should be fed with Leube's pancreatized meat (the formula for which I have slightly modified)[1] twice in the twenty-four hours. Should there be a difficulty in retaining the enemata (though the solid kind just mentioned causes far less irritation than the liquid injections, such as beef-tea or eggs beaten up in milk, which are commonly used), or should the food be returned without having undergone any digestive change, the permanent œsophageal tube (Fig. 10, p. 16) may be introduced. It should be explained to the patient or his friends that the use of this instrument is attended with some danger, but that it may be the means of prolonging life for a few days—occasionally for a week or two, or even longer.

If thirst be greatly complained of in the last days, tepid footbaths of milk often comfort and refresh the patient, and possibly afford some slight nourishment.

The question of a cutting operation has been deferred to this late stage of the subject for the sake of clearness, but in actual practice it must be entertained directly the diagnosis of the disease is accurately established. Surgical measures, which at an early period may be attended with the happiest results, if postponed till the patient is worn out with disease, can only end in failure, and add to his sufferings. The point which has first to be considered is whether *excision* of the growth is practicable, the alternative operations being *œsophagostomy* and *gastrostomy*.

The idea of excising a portion of the gullet appears to have originated with Billroth,[2] who in 1872 published a short account of two experiments made on dogs. In each case a part of the œsophagus was cut out; one dog died five days afterward from the result of an accident, but the other recovered completely, and lived for several months, when he was killed, in order that the parts might be examined. The first surgeon, however, so far as I am aware, who attempted to carry out this proceeding in the human subject was Kappeler,[3] who in 1875 endeavored to excise a portion of the gullet in a man, aged forty-two, who had suffered from dysphagia for about eight months. The operator, however, was baffled by the extent and connections of the diseased mass, which also prevented him from opening the tube below the stricture. He had, therefore, to content him-

[1] See vol. i., p. 425.
[2] Langenbeck's Archiv für klin Chir., 1872, Bd. xiii., p. 66.
[3] Deutsche Zeitschr. für Chirurgie, 1877, Bd. vii., p. 379.

self with introducing a catheter into the œsophagus above the seat of disease, and trying to force a passage downward. The patient died on the following morning. Resection of the œsophagus was again attempted by Kappeler[1] in 1876, but with no better result. The patient was a man, aged sixty-five, who had felt difficulty in swallowing for three years and a half. The main features of this case were almost identical with the one just related, as far as the operative procedures are concerned, and the result was equally unsatisfactory, as the patient died on the second day. A year or two later Professor Czerny[2] was more fortunate. The patient in this instance was a woman, aged fifty one, who had suffered from dysphagia for some months. Czerny made an incision from the level of the hyoid bone down to the sternum along the anterior edge of the sterno-mastoid on the left side ; the omo-hyoid muscle was divided, the thyroid body was pushed upward and inward, and the œsophageal tumor, which could then be felt with the finger, was carefully dissected out. A segment of the gullet, involving the upper 6 ctm. of the canal, was removed, and the upper orifice of the lower section of the divided tube was stitched to the edges of the skin-wound. A catheter, through which the patient could be fed, was then passed into the œsophagus through the wound, and the lips of the superficial incision were brought together. By the fourth day all the sutures were removed, and the catheter was replaced by a large hollow bougie, which at first was left permanently *in situ*, but in a short time was taken out, and only introduced when nourishment had to be given. The patient learned to feed herself in this manner, and five months after the date of the operation she was still in perfect health, without any trace of recurrence. She continued to use the sound for the purpose of taking food. On examination a partition about half a centimetre in thickness was found closing the lower aperture of the pharynx, thus cutting off all communication between the upper and lower parts of the pharyngo-œsophageal canal. In this instance the disease was epitheliomatous in character, and the mass encircled the gullet, but no perforation of the tube or extension of the growth beyond its walls had taken place, and there were no enlarged glands. While, therefore, Professor Czerny must be congratulated on the highly successful issue of his bold procedure,[3] the case itself was an exceptionally favorable one for the operation.

The fact, however, that malignant disease of the gullet spreads to contiguous organs at an early period is likely to prevent the operation of resection being frequently applicable.

The surgeon has in the next place to take into consideration the chances offered to his patient by œsophagostomy or gastrostomy. The advantages and disadvantages of these procedures will be fully considered under the head of Cicatricial Stricture of the Gullet, a condition which is much more favorable for such operations than where the narrowing is due to malignant disease.

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[1] Ibid. [2] Beiträge z. operat. Chir., Stuttgart, 1878, p. 41.

[3] While these sheets are passing through the press I learn from Professor Czerny that the woman died rather more than a year after the operation described in the text. Recurrence of the disease took place to an extent which rendered tracheotomy necessary, and the patient succumbed some weeks afterward (private letter, dated July 22, 1882).

SARCOMATA.

Sarcomata are occasionally met with in the œsophagus. Rosenbach [1] has reported a case in which a growth about the size of a common fowl's egg was attached to the right side of the gullet just below its junction with the pharynx. The tumor was soft, slightly lobulated, and almost transparent, closely resembling an ordinary nasal polypus. On microscopic examination, however, it was found to be a round-celled sarcoma. Tracheotomy having been first performed the growth was removed by subhyoid pharyngotomy. In another case, reported by Chapman,[2] several tumors, partially connected, varying from one and a half to two inches in diameter, were found occupying the upper orifice of the œsophagus.

Cases of calcification, cartilaginous stricture, and even ossification of the œsophagus are referred to by some of the older authors, such as Sampson,[3] Morgagni,[4] Gyser,[5] and Desgranges.[6] It is not improbable that calcification sometimes occurs in this situation,[7] but I know of no authentic instance of such a transformation recorded in modern literature.

NON-MALIGNANT TUMORS OF THE GULLET.

(Synonyms : Benign Growths of the Gullet. Polypi of the Gullet.)

Latin Eq.—Tumores non maligni œsophagi.
French Eq.—Tumeurs non malignes de l'œsophage.
German Eq.—Gutartige Geschwülste der Speiseröhre.
Italian Eq.—Tumori non maligni del esofago.

Definition.—Growths of benign character, generally mucous or fibro-mucous in structure, giving rise to nausea, sometimes to pain, occasionally to dyspnœa, and frequently to extreme dysphagia.

History.—In 1717 Schmieder [8] published an example of polypus of the œsophagus, but I know no particulars of the case beyond those contained in the title-page of his

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[1] Berlin. klin. Wochenschrift, September 20 and 27, 1875.
[2] Amer. Jour. Med. Sci., October, 1877, vol. cxlviii., p. 433.
[3] Miscell. Curios., 1613, p. 170.
[4] De sedibus et causis morb., ep. xxviii., art. 15, ed. sec., Patavii, 1765, t. ii., p. 10.
[5] De fame lethali ex callosâ œsoph. angustiâ, Argentorati, 1770, p. 16.
[6] Journ. de Corvisart, 1801, t. iv., p. 203.
[7] Both enchondromata and osteomata have been found in the mucous membrane of the trachea, and though the normal presence of cartilage in the windpipe renders it a more likely locality for the development of these growths, it is quite possible that they may also occur in the gullet.
[8] Dissert. de polypo œsophagi vermiformi rarissimo e pulveris sternutatorii Hispani abusu progenito. Italæ, 1717.

essay.[1] In 1750 Vater [2] reported the case of a man who had suffered from dysphagia for some time. This improved after he had vomited a "fleshy mass about the size and thickness of a finger;" subsequently, however, the difficulty of swallowing recurred, and the patient sank from inanition. After death the walls of the œsophagus above the cardiac orifice were found thickened, the lumen of the tube being much narrowed. There was the appearance of a cicatrix on the œsophageal wall at this part. This seems to have been an example of simple polypus, which, as in Coats's case (see below) gave rise to chronic inflammation, and probably ulceration of the mucous membrane. The inflammatory changes were presumably too far advanced to permit the recovery of the patient after the spontaneous separation of the growth. In 1763, Dallas [3] met with a remarkable instance, in which the polypus had so long a stalk that, on making the patient retch, it was projected into the mouth as far as the front teeth. In 1764, De Graef [4] reported the case of a patient who died from inanition, in whose œsophagus was found a small cone-shaped growth, with its apex toward the cardiac opening. In 1776, Macquart [5] published an account of a tumor in the gullet, which does not seem to have been malignant. In 1784, Schneider [6] gave a description of a case in which three polypi were found in the gullet after death. Baillie,[7] in 1802, stated that he had seen a fibrous growth springing from the inner coat of the gullet. In 1806, Vimont[8] placed on record two examples of œsophageal polypi, both occurring in women who had long suffered from goitre. Dubois,[9] in 1818, related an instance in which an œsophageal polypus had been ligatured, and the patient was suffocated from the tumor coming away in his sleep and finding its way into the air-passage. Rokitansky [10] related a case in which a very large polypus in the gullet caused little or no dysphagia. In 1847, Arrowsmith [11] described a pedunculated and freely movable polypus growing at the upper part of the gullet, and admitting of easy removal if the affection had been recognized. In 1857, Middeldorpf [12] having met with a remarkable example of the disease, and having collected a few previously published cases, wrote a monograph of considerable value on the subject. Since then examples of myomatous polypi in the œsophagus have been published by Eberth,[13] Coats,[14] Fagge,[15] and Tonoli,[16] while Wyss,[17] Ziemssen,[18] and Sappey,[19] have recorded the occurrence of small cystic tumors in the same situation. I have myself met with three examples of non-malignant growth in the gullet.

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[1] In a list of examples of œsophageal polypi given by Middeldorpf at the end of his essay (De polypis œsophagi, Vratislaviæ, 1857, pp. 22, 23), cases are cited from Pringle, Gilbert, Waugh, and Lesueur. These, however, have not been included in the above history, as they were not true benign polypi. Pringle's case (Medical Essays and Observations by a Society in Edinburgh. Edinburgh, 1737, second edition, vol. ii., pp. 324, 325) was probably malignant; Waugh's (Ibid., vol. i., p. 274) was clearly an example of œsophageal abscess terminating in complete recovery after spontaneous rupture of the sac; whilst the growth in Lesueur's case (Revue Méd.-Chir. de Paris, 1850, t. viii., p. 360) is distinctly stated by the reporter to have been encephaloid cancer.

[2] Dissert. inauguralis de deglutitione difficili et impedita. Vitembergæ.

[3] Edin. Literary and Phys. Essays, vol. iii., p. 525. This case is associated with the name of Monro, who saw the patient in consultation with Dallas, and suggested the ligature. It is related at length in Monro's Morbid Anatomy of the Gullet, etc., 1830, third edition, p. 426.

[4] Diss. illustrans hist. de callos. excrescent. œsoph. obstruente. Altorfii, 1764.

[5] Obs. sur une Tumeur dans l'Œsophage. Hist. et Mém. de la Soc. R. de Méd. 1776, Hist., p. 280.

[6] Chirurg. Geschichte. Chemnitz, 1784, Bd. x.

[7] Pathological Anatomy, p. 102.

[8] Annales de la Soc. de Méd. Prat. de Montpellier, t. viii., p. 69.

[9] Propos. sur l'Art de Guérir. Thèse de Paris, 1818, No. 104.

[10] Œsterr. medicin. Jahrb. 1840, Bd. xxi.

[11] Méd.-Chir. Trans. 1847, vol. xxx., p. 229.

[12] De polypis œsophagi. Vratislaviæ, 1857.

[13] Virchow's Archiv 1868, Bd. xliii., p. 137.

[14] Glasgow Med. Journ. February, 1872.

[15] Trans. Path. Soc. London, 1875, vol. xxvi., p. 94.

[16] Gazetta Medica Ital. Lombard. 1880, Serie viii., t. ii., No. 49, p. 479.

[17] Virchow's Archiv. 1870, Bd. li., p. 144.

[18] Cyclopædia of Pract. Med., vol. viii., p. 161.

[19] Traité d'Anatomie Descriptive. Paris, 1879, Troisième édition, t. iv., p. 155.

Etiology.—These growths are very rare, and probably originated in most instances in chronic inflammation. As far as the recorded cases go, it would appear that œsophageal polypi are more common amongst men than amongst women. In De Graef's case the patient had been a free drinker, and had frequently suffered from inflammation of the throat and tonsils, but none of the others show a similar history. As regards myomata, it was to be expected, *à priori*, that they would be occasionally met with in a muscular canal like the œsophagus.

Symptoms.—The most frequent symptom is slowly increasing dysphagia. The disease, however, may exist for many years, as in Rokitansky's case, even when the growth is very large, without interfering with deglutition, until an advanced period of its development. Sometimes no symptom whatever has been observed, and the tumor has only been discovered after death.[1] In other cases the dysphagia has been attributed to cancer.[2] These growths are often pedunculated, and the stalk may be so long that, as in Dallas's patient, the polypus, in retching, may be projected into the mouth. Sometimes it may be seen with the laryngoscope, at the lower part of the pharynx ; and in one instance, hereafter reported, I was able, by means of the œsophagoscope, to obtain a view of a growth situated about one inch below the cricoid cartilage. A bougie can occasionally be passed and withdrawn without difficulty, although the operation may cause severe pain, as in Coats's case. On the other hand, in some instances, an obstruction may be perceived in using the instrument, or it may be impossible to pass it at all. In Tonoli's case a movable tumor could be distinctly felt with the bougie. Sometimes the tumor has been known to give rise to dyspnœa and indistinctness of utterance,[3] and in one instance great pain was experienced ; but in this case (Coats's) the pressure of the growth had induced extensive ulceration of the œsophageal walls, and the pain was probably due to this condition. Middeldorpf's patient complained of severe pain in the fauces and in the back.

In one case (Vater's) the growth separated spontaneously, and was ejected by the mouth ; but even in this instance, as already remarked, the patient died from inanition, apparently owing to the chronic inflammation which had been set up by the growth.

Pathology.—The most common kinds of non-malignant growths met with in the œsophagus are those of a simple warty or *papillary* structure. "They are sometimes single, at other times in large numbers, scattered over the whole length of the tube."[4] Small *cysts*, containing a clear colorless viscid fluid, are occasionally found ;[5] they probably originate from obstructive distention of the mucous follicles. Wyss[6] has described a case in which a cyst was situated on the posterior wall of the œsophagus 1½ ctm. from the cardia. It was of the size of an apple, and was filled with liquid, which was found, on microscopic examination, to contain globules of free mucus and ciliated epithelium. Sappey[7] states that he has on several occasions seen cysts in the gullet, and he describes one case in which there were about twenty small cysts, varying from ten to twelve millimetres in length. *Fibromata* are also met with, and often attain a much larger size than the growths already described. They are usually single, but occasionally multiple. In Schneider's case, as already remarked, three polypi were found after death. These tumors vary in size from a

[1] Schmieder ; Fagge. [2] Coats. [3] Dallas.
[4] Ziemssen's Cyclopædia, vol. viii., p. 168. [5] Ibid. Also Fagge : Loc. cit.
[6] Loc. cit. [7] Op. cit., t. iv., p. 155, foot-note.

currant to a hazel-nut, but sometimes attain much larger proportions. In Rokitansky's case the polypus measured seven and a half inches in length, and its broadest part was two and a half inches in thickness. The mucous membrane covering the growth is generally smooth, but sometimes it is rough, and covered with papillæ. In Baillie's case the surface of the growth was considerably ulcerated. In the well-known instance reported by Middeldorpf the exact origin of the growth was not ascertained. It may have grown from one of the ary-epiglottic folds or from the posterior part of the cricoid cartilage, or from the upper part of the œsophagus. On making the patient vomit, a large purple body, which at first appeared to be the tongue, was thrown forward against the teeth. The tumor, which was ligatured, and then removed, was three inches long, and half an inch wide; it was smooth and glistening, somewhat uneven and warty at the lower part, and superficially ulcerated. It had a covering of pavement epithelium, beneath which were conical papillæ, and under these again was embryonic connective tissue. In Tonoli's case the growth was oblong in shape, and was attached by a short stalk to the left side of the gullet at the lower part of its middle third.

Weigert[1] has reported a case of *adenoma polyposum* about the size of a hazel-nut, which grew from the anterior wall of the lower third of the œsophagus. It contained numerous hollow spaces, lined with cylindrical epithelium, and surrounded by a stroma of connective tissue. Zenker and Ziemssen,[2] in commenting on this case, remark that it probably originated in the mucous follicles.

Lipomata are stated by Laboulbène[3] to be occasionally found in the œsophagus, but he does not refer to any actual cases.

As already stated, examples of *myomata* have been recorded by Eberth, Arrowsmith, Coats, and Hilton Fagge. In the last-mentioned case the patient, who was under the care of Mr. Bryant, died from the effects of an injury to the knee-joint, and there was no mention of dysphagia in the clinical history. The tumor grew from the anterior wall of the œsophagus just below the level of the bifurcation of the trachea. It was about two inches in length, one and a quarter in width, and one inch in thickness. In Coats's case the patient was a man, aged sixty-one, and the growth was elongated and irregularly oval in shape. It was attached to the posterior wall of the œsophagus six inches and three-quarters below the level of the glottis by a thin fibrous pedicle, one inch and three-quarters long, which was inserted into the body of the tumor two inches below its upper end. The polypus measured four inches and three-quarters from above down, two from side to side, one to one and a quarter from before backward. The surface was irregularly lobulated, generally grayish in color, but of dark brown tint at the upper part. The body of the tumor was horizontally constricted, the upper part being larger than the lower. Portions of the surface had an appearance of sloughing. On section the growth was tough, but not very dense. The œsophagus was dilated near the seat of implantation of the polypus, and its surface was of a slaty color, and ulcerated in several parts, two of the ulcers having eaten through the mucous coat, and one through the entire thickness of the gullet-wall.

Diagnosis.—There is considerable difficulty in diagnosing these tumors, for, as has been observed, they sometimes give rise to no symptoms at all,

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[1] Virchow's Archiv. 1876, Bd. lxvii., pp. 516, 517.
[2] Cyclopædia, vol. viii, p. 169.
[3] Nouv. Élém. d'Anat. Pathol. Paris, 1879, p. 91.

while in other instances they produce almost the same symptoms as malignant growths. As compared, however, with cancer, the dysphagia, as a rule, progresses much more slowly, and it may be years before it gives rise to serious inanition. When the growth has a long pedicle it may be occasionally protruded into the mouth, and in other cases it may be seen with the laryngeal mirror or with the œsophagoscope. Careful examination of the neck and chest will eliminate cervical and mediastinal tumors.

Prognosis.—The prospects of the patient must depend on the situation of the growth, on its size, and on the rapidity of its increase. Small warty growths need give rise to no anxiety, but if the polypus be large it must be looked upon as a serious disease, which at any moment may so much interfere with deglutition as to bring the patient's life into immediate danger.

Treatment.—When the tumor is projected into the mouth it may be ligatured and cut off. This course, as already mentioned, was pursued by Middeldorpf, while in the earlier case of Dallas a ligature was applied, the polypus was again swallowed, and allowed to come away *per anum*. In this instance, owing to the dyspnœa that was produced when the polypus was vomited into the mouth, it was necessary to perform tracheotomy as a preliminary measure. When a ligature has been applied it is highly desirable that the patient should remain under close observation, as in one case in which separation occurred during sleep, the growth became impacted in the pharynx and caused fatal apnœa.[1] In two cases that came under my own care some years ago, in which I had not diagnosed the growth, polypi were removed with the parasol-probang, which was used because the patients were under the impression that they had foreign bodies in their throats. In a more recent instance I was fortunately able, by means of an œsophagoscope, to diagnose a small polypus situated about one inch below the upper orifice of the œsophagus, and to remove it with forceps.

Should a growth, which cannot be removed *per vias naturales*, occupy the upper part of the gullet, recourse should be had to œsophagotomy, while if the tumor be in the lower part of the tube, gastrostomy offers a prospect of permanent relief.

CASES OF NON-MALIGNANT GROWTH IN THE GULLET.

Case 1.—Mrs. M., aged thirty-seven, was sent to me by Mr. Symonds, of Oxford, in March, 1874. She had felt some difficulty in swallowing for eleven months; but during the eight weeks previous to her coming under my observation, the dysphagia had become intensified to such a degree that she could take only liquid nourishment. The patient stated that she had lost flesh, and she was afflicted with a troublesome cough. Laryngoscopic examination showed that her larynx was healthy, and no sign of disease could be found in the lungs. From the fact that she had first noticed a difficulty in swallowing while eating hashed pheasant, Mrs. M. was under the impression that a bone had stuck in her throat. A bougie (No. 10 English measure) was passed with some trouble, a hitch having been felt in the upper third of the gullet. Two days later I introduced a parasol-probang, and on withdrawing it with a little difficulty, a round smooth growth of about the size of a marble, with a pedicle half an inch in length, was brought up with the instrument. The patient spat up two or three drachms of blood, and next day was unable to swallow even liquids. On the second day, however, the dysphagia had abated, and by the end of a week it had quite passed off. I saw this lady again in 1875, and she had experienced no further difficulty in deglutition. On microscopic examination the growth proved to be of true fibrous structure, the fibrillæ being arranged concentrically round a white nuclear portion, and the whole being covered with squamous epithelium.

[1] Dubois: Loc. cit.

CASE 2.—The Rev. P. E., aged forty-seven, consulted me in June, 1875, on account of difficulty of swallowing. This symptom was first noticed two years and a half previously, after eating some fish, and the patient attributed the trouble to the lodgment of a bone. The difficulty in swallowing had increased by slow but not regular degrees. At first it was slight, and only came on occasionally, while at other times the food went down perfectly well. During the first six months of 1874 the dysphagia passed off, but in the beginning of July of that year it suddenly returned, and since then there had always been some trouble. The patient stated that he had consulted several practitioners, and on two occasions attempts had been made to pass a bougie, but he was under the impression that the instrument had been stopped in the upper part of the throat. These measures had not given him any relief. At the patient's urgent solicitation, rather than with the idea of meeting with any foreign body, I passed a parasol-bougie. Though it went down easily, I had some difficulty in pulling it up, and was about to release the web of the bougie, when the obstruction suddenly yielded, and on withdrawing the instrument a small pedunculated tumor, about the size of a bantam's egg, fell from the patient's mouth. He subsequently brought up about a teacupful of blood. I forbade the patient taking any solid food, but this injunction was scarcely necessary, as for several days he experienced considerable pain even in swallowing liquids. There was no return of the bleeding. The patient ultimately made a good recovery, and I heard in January, 1878, that he was perfectly well. The tumor was of somewhat oval shape, though one side was very much flattened, and the surface ulcerated. On microscopical examination made by Dr. Stephen Mackenzie, it was found to be of fibrous structure, but covered, except at the ulcerated point, by pavement epithelium.

CASE 3.—Miss P., aged twenty-seven, consulted me in August, 1880, on account of difficulty of swallowing, which had existed more or less for six or seven years. Examination with the œsophagoscope revealed an oval, semi-transparent polypus, situated on the right of the gullet, one inch below the cricoid cartilage. On August 28th, in the presence of Mr. C. L. Taylor, I removed a growth about the size of a white currant. The patient felt some slight pain for twenty-four hours after the operation; but at the end of a week she was able to swallow perfectly, and has not since had any recurrence of the symptoms. The following is the report of Dr. Stephen Mackenzie on the specimen:—"The surface of the growth is covered with squamous epithelium, beneath which is a very lax œdematous and highly vascular mass, with numerous lymphoid cells (leucocytes) infiltrated into the tissue. It appears, in fact, to be a polypus arising from chronic inflammation of the œsophageal mucous membrane."

SYPHILIS OF THE GULLET.

Latin Eq.—Syphilis œsophagi.
French Eq.—Syphilis de l'œsophage.
German Eq.—Syphilis der Speiseröhre.
Italian Eq.—Sifilide del esofago.

Definition.—Constitutional syphilis manifesting itself within the gullet by the usual secondary or tertiary lesions, or more rarely occurring in the congenital form, causing dysphagia and occasionally leading to death by marasmus.

History.—Severinus,[1] who lived in the latter part of the sixteenth and the first half of the seventeenth centuries, appears to have been the first writer who called attention to this disease, and his contemporary, Rhodius,[2] recorded the case of a patient suffering from syphilis, in whom a growth was found originating from cicatricial thickening at the lower end of the œsophagus. Ruysch,[3] who flourished somewhat later, gave an

[1] Quoted by Lieutaud: Hist. Anat. Med. Parisiis, 1767, t. ii., lib. iv., obs. 105.
[2] Obs. Anat. Med. Patavii, 1657, cent. ii., obs. 46.
[3] Advers. Anat. Med. Chir. Amstelodami, 1717, decad. i., obs. x., p. 24 et seq.

account of a case treated by himself and Boerhaave, in which very severe dysphagia, due apparently to some obstruction at the level of the fifth or sixth dorsal vertebra, yielded to a short course of mercurial baths.[1] In 1820 Palletta[2] described an example of dysphagia occurring in a patient who had previously suffered from syphilis; the difficulty of swallowing came on on two occasions, and each time readily yielded to mercurial treatment. The first mention of congenital syphilis in the œsophagus was made by Billard,[3] who found ulcers which he considered to be of specific character, in the gullet of a girl six days old. In recent years a few additional examples of œsophageal syphilis have been observed. In 1860, West,[4] of Birmingham, published two cases which settled the question as to the occurrence of syphilis in the œsophagus. He also quoted three other supposed examples of the same disease, two from Carmichael, and one from Turner. From a careful perusal of the notes, however, it appears that in all these instances the disease was situated in the *pharynx*. West[5] soon afterward related a third example occurring within his own experience, in which a woman, suffering from rupia and ulceration on the face and legs, died from marasmus, consequent on inability to swallow. Follin[6] refers to two cases which had come under his notice. In one there was palmar psoriasis and dysphagia; the latter symptom disappeared without instrumental treatment. In the other the lesion was probably more severe, and only a partial cure was effected. Virchow[7] states that he has in his possession two specimens illustrating the disease. In one of them he describes a softened gumma closely connected with a contracting cicatrix in the œsophagus. In the other case the preparation shows a flat ulcer with a "fatty indurated base." Wilks and Moxon[8] affirm that they have seen in a *syphilitic subject* two yellowish gummatous patches in the œsophagus, and in another instance they describe the gullet as having been penetrated by a large soft syphilitic deposit originally outside it. The same authors also allude to a specimen showing a contracted cicatrix in the œsophagus, which they consider to be probably due to syphilitic lesion. Knott[9] has added two cases. One of them—a specimen of ulceration of the œsophagus—was brought before the Pathological Society of Dublin in 1839 by Cusack. In another case that had come under Knott's own notice, severe œsophageal dysphagia occurred in a patient suffering from tertiary syphilis, who quickly recovered the power of swallowing under the use of iodide of potassium. In 1868 Steffen[10] recorded two cases of ulcers of the œsophagus found in children suffering from congenital syphilis. In 1870 a case was published by Maury,[11] of Philadelphia, in which syphilitic stenosis of the gullet rendered gastrostomy necessary. In 1873 Podrazki[12] described a case in which a man who had suffered from severe tertiary syphilis experienced difficulty in swallowing during more than two years; gradual dilatation was tried without success, but great benefit was afforded by mercurial inunction. After death a cancerous stricture was found, but from the long duration of the symptoms, and the temporary good effect of the anti-syphilitic remedy, it is probable that the affection was venereal at least in the earlier part of its course. In 1874[13] I recorded a case of probable syphilitic ulceration of the œsophagus which had caused dysphagia on previous occasions, and which was relieved by iodide of potassium. In the following year an example of œsophageal syphilis was related by Godou.[14] The patient, a man aged twenty-four, recovered rapidly under the use of iodide of potassium and ice. In 1876 Reimer[15] published a case of congenital syphilis occurring in a boy of twelve;

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[1] Haller has been quoted (Follin, Rétrécissements de l'Œsophage. Paris, 1853, p. 30) as describing a case of syphilitic stricture of the gullet which was cured by the use of mercurial pills. On reference to the original report, however (Opuscula Pathologica, obs. lxxviii., in Haller's Opuscula Minora, Lausannæ, 1768, t. iii., pp. 380, 381), I can find no evidence whatever, either that the disease was venereal, or that Haller considered it to be so.

[2] Exercit. Pathol. Mediolani, 1820, p. 226 et seq.

[3] Traité des Maladies des Enfants nouveau-nés Paris, 1833, p. 307.

[4] Dublin Quarterly Journ. of Med. Science. February, 1860, No. 57, p. 86 et seq.

[5] Ibid., August, 1860, vol. xxx., p. 29 et seq.

[6] Traité Élém. de Pathologie externe. Paris, 1861, t. i., p. 696.

[7] Die Krankhaften Geschwülste. Berlin, 1864-65, Bd. ii., p. 415.

[8] Pathological Anatomy. London, 1875, second edition, pp. 365, 366.

[9] Pathology of the Œsophagus. Dublin, 1878, p. 161.

[10] Jahrb. für Kinderheilk., vol. ii., p. 144.

[11] Amer. Journ. Med. Sci., April, 1870, p. 356.

[12] Wien. Med. Wochenschr, 1873, Nos. 33, 35, 36.

[13] Lancet, May 30, 1874.

[14] Archives of Dermatology, 1875, vol. i., p. 276.

[15] Jahrb. f. Kinderheilk., vol. x., p. 98.

besides many other lesions, there was a sinus opening on the surface of the neck and leading into the œsophagus. The tissues of the gullet for some way round the ulcer were diseased. In 1877 Bryant[1] related an instance of œsophageal stenosis occurring in a tubercular subject, which he considers to have been due to syphilitic ulceration. The dysphagia was so severe that gastrostomy was judged necessary. In the same year Luton[2] gave a brief account of a case in which a man aged forty, suffering from syphilitic disease of the gullet which had resisted treatment by mechanical dilatation, was speedily and permanently cured by iodide of potassium. A case has been reported by Billroth[3] in which serious difficulty of swallowing was caused by syphilitic deposit behind the cricoid cartilage. The patient, a man aged fifty-five, had condylomata in the mouth and on the tongue. The dysphagia yielded promptly and permanently to anti-venereal remedies combined with mechanical dilatation.

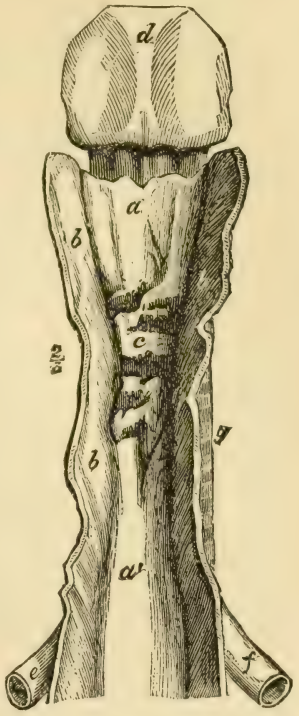

FIG. 14.—Syphilitic Cicatrices in the Œsophagus. (Seen from behind.) *a* and *a'*, anterior wall of the gullet; *b*, sides of the gullet thrown outward; *c*, situation of transverse ridges of cicatricial tissue (above and below them vertical ridges are seen); *d*, posterior surface of cricoid cartilage (between *d* and *a* a portion of the posterior wall of the trachea is visible); *e*, left, and *f*, right bronchus; *g*, edge of trachea.

Etiology—When the system has become infected with the venereal poison, local manifestations may take place in any part of the body. The œsophagus, however, shows comparatively little proclivity to syphilitic affections, and is probably attacked only when previous disease or injury has produced a *locus minoris resistentiæ* at some point in the canal. Hereditary syphilis probably shows itself but seldom in the gullet; indeed, I know of no cases but those of Billard, Steffen, and Reimer, above referred to, in which this form of the affection has been actually observed.[4]

Symptoms.—The chief of these is dysphagia, which, in its mode of development, greatly resembles that due to swallowing an irritant or mild corrosive poison. Thus, difficulty of deglutition occurs at the time the ulcer forms, disappears as it heals, and recurs when the cicatricial tissue begins to shrink.

Pathology.—The morbid changes closely resemble those met with in the pharynx and larynx—that is to say, simple ulceration of the mucous membrane may take place; or gummata may be formed in the submucous tissue, which slowly break down, ulcerate, and give rise to rigid contracting cicatrices.[5] In my first case there was a single raised cicatricial band just below the cricoid cartilage. It was nearly half an inch in width, and ran round the tube for three-fourths of its circumference, reducing the canal to the size of a No. 3 œsophageal bougie (old English scale). In my second case (Fig. 14) slightly raised transverse

[1] Lancet, 1877, vol. ii., p. 9.

[2] Nouv. Dict. de Méd. Paris, 1877, t. xxiv., pp. 403, 404.

[3] Clinical Surgery, Syd. Soc. Transl. London, 1881, p. 128.

[4] It was formerly believed that congenital syphilis of the larynx was extremely rare, but the recent researches of Dr. John Mackenzie, of Baltimore (Amer. Journ. Med. Sci., October, 1880), have proved this condition to be of more frequent occurrence than was previously supposed, and if the gullet could be thoroughly examined during life in patients suffering from congenital syphilis, this canal also would probably be found to be affected much more often than is generally suspected.

[5] Berkeley Hill: Syphilis and Local Contagious Disorders. 1868, p. 127.

ridges occupied the anterior wall of the gullet one inch and a half below the cricoid cartilage, the upper and lower bands giving off short vertical spurs. There was very little thickening of the walls of the gullet except immediately beneath the cicatricial bands. In one of West's cases the œsophagus was constricted four inches below its upper orifice for about two inches and a half, and the narrowed portion, owing to thickening of the mucous membrane, and fibrous deposits in the form of bands and ridges, presented very much the appearance of an old stricture of the urethra. In another case reported by West the œsophagus presented reddish livid erosions for about two inches above the cardiac orifice, and there was a considerable amount of fibrous deposit in the submucous tissue. Laboulbène [1] found in the gullet of a man, aged thirty, who had died of acute œdema of the larynx caused by an ulcerated growth in that situation, scars of old ulcers and interstitial deposits of a hard whitish fibroid material which infiltrated the mucous membrane. All who saw it agreed that it was of gummatous nature.

Diagnosis.—The diagnosis of syphilitic disease of the gullet is extremely difficult, and under the most favorable conditions can never amount to anything more than conjecture. The affection presents no pathognomonic feature, and the surgeon can only come to a probable conclusion by a consideration of all the circumstances of the case. The history of the patient must always be carefully investigated. Inquiries should be made as to the previous occurrence of skin eruptions, loss of hair, miscarriages, nocturnal pains in the shin-bones, and the various other symptoms indicative of constitutional syphilis. The skin, tongue, pharynx, and larynx should be carefully examined to see if there are any old scars or patches of induration; nodes should be sought for on the front of the tibia, and the condition of the sub-occipital glands should be ascertained. The duration of dysphagia for some time, its apparent complete cure by anti-venereal remedies, and its subsequent recurrence, are the salient features of the malady.

It is not to be wondered at, however, that in a matter so beset with difficulties, observers are often led astray. It is likely that in many instances syphilis of the gullet has been mistaken for cancer, and, on the other hand, erroneous conclusions may be arrived at even when the history and course of the complaint seem most clearly to indicate a specific origin. Thus, in a case of dysphagia which came under my own notice, I supposed the symptom to be one of syphilitic lesion at the upper part of the œsophagus. This was rendered more probable by the fact that the patient was suffering from a well-marked venereal affection of the pharynx. After death, however, absolutely no trace of disease could be seen in the gullet, and the difficulty of swallowing was found to have been due to great enlargement of the posterior part of the cricoid cartilage.

Prognosis.—This is very unfavorable, for though when the lesion only amounts to superficial ulceration the patient can generally be relieved by treatment, there is a great probability of permanent stricture resulting from subsequent cicatricial contraction. Although this may be sometimes combated for a time by the use of bougies, it very often happens that as soon as the patient feels a slight improvement in his condition he will dis-

[1] Nouv. Élém. d'Anat. Pathol. Paris, 1879, p. 96. The same writer also states that he had met with an example of stricture of the gullet in which a woman suffering from tertiary syphilis was cured by iodide of potassium, and refers to two similar cases related to him by Fournier.

continue his attendance, and when he again presents himself it may be impossible to pass an instrument. When a large gumma forms, or when the walls of the gullet become much thickened, the prospects of the patient are still more gloomy.

Treatment.—The constitutional remedies which are suitable in other forms of tertiary syphilis may be employed here. When the presence of gummata or specific ulcers is suspected, iodide of potassium, in doses of ten grains three times a day, will probably quickly relieve all the symptoms. Ammonia, which is so useful in combination with this drug, should not be given in these cases, as it is apt to irritate the gullet. Should frequent relapses take place, bichloride of mercury (one-sixteenth of a grain) twice or three times a day, or the cyanide of mercury (one-eighth of a grain) may be found beneficial.

The proper treatment of the actual constriction of the œsophagus will be considered under Cicatricial Stricture of the Gullet.

The first two of the following cases were undoubtedly examples of syphilitic disease of the œsophagus, and the last one probably belongs to the same category :

Case 1.—Sarah H., a married woman, aged forty-one, applied at the Throat Hospital in June, 1874, on account of difficulty in swallowing. She stated that she had had three miscarriages. There was a large rupial eruption over the right shin-bone. Careful examination of the pharynx and larynx gave negative results ; but on attempting to explore the gullet it was found impossible to pass the bougie beyond the upper orifice of the canal, even when the patient was under chloroform. Iodide of potassium was given, liquid diet of highly nutritious quality was obtained for her, and she was directed to wean an infant which she was suckling. In a few weeks Sarah H. had so far recovered as to be able to swallow semi-solid food. She thereupon discontinued her attendance. In February, 1875, however, word was brought to the hospital that she was dying. Mr. Poyntz Wright saw her several times, but in spite of every effort to overcome the obstruction, her œsophagus was found impermeable, and she soon died from exhaustion. After death the canal, about an inch below the cricoid cartilage, was found so much narrowed that a No. 3 bougie (old English scale) could with difficulty be passed into it. The contracted portion extended downward for less than half an inch in a vertical direction, and consisted of a raised ridge, occupying three-fourths of the circumference of the tube. Two whitish nodules, presenting all the appearance of syphilitic gummata, one about the size of a filbert, and the other somewhat smaller, were found in the liver.

Case 2.—John W., aged sixty-five, came to me at the Throat Hospital in July, 1876, on account of dysphagia. He had suffered from primary syphilis seven years previously, and his palate had been perforated by an ulcer in 1874. The patient was much emaciated, and very feeble ; he had also paresis of the left arm. Examination of the pharynx showed no signs of the disease, and the larynx was healthy, with the exception of slightly impaired mobility of the left vocal cord. The patient could not swallow solids at all ; but liquids went down pretty easily. On auscultation of the gullet prolonged gurgling noises were heard over the sixth and seventh vertebræ, while below that point the œsophageal sounds were scarcely audible. An attempt to pass a No. 6 bougie (old English scale) altogether failed, owing to obstruction just below the cricoid. Stricture was diagnosed, and it was thought that the disease might be syphilitic. No improvement, however, was produced by iodide of potassium ; the dysphagia gradually got worse, and the patient died in January, 1877. Post-mortem examination showed fine, slightly raised, almost transverse ridges, on the anterior wall of the gullet (Fig. 14). The uppermost ridge was about an inch and a half below the lower border of the cricoid cartilage, and from it two spurs passed upward. The lowest transverse ridge also sent a prolongation downward. These ridges were darker in color than the rest of the mucous membrane, and presented an uneven surface. The walls of the gullet were very little thickened, except just beneath the ridges.

Case 3.—A man, aged sixty-one, came under my care in June, 1873. He had suffered since the foregoing February from dysphagia, which had gradually become worse, till, when I saw him, he could only swallow fluids. He had had venereal disease eighteen years before, and had on two different occasions since then suffered from difficulty of swallowing. One of these attacks had occurred eleven and the other

four years previously. There was neither cough nor expectoration, and the pharynx appeared healthy, with the exception of a slight cicatricial puckering on the right anterior pillar of the fauces. The larynx was normal. On auscultation of the gullet, however, the "morsel" was found to be arrested at a point opposite the sixth dorsal vertebra, and on exploration with the bougie a tight stricture was recognized about the junction of the lower with the two upper thirds of the gullet. Iodide of potassium was given, and in ten days the patient had recovered his power of swallowing.

Although the evidence in this case amounts to no more than probability, I think it may be accepted as a genuine example of syphilitic stenosis. The previous history of the patient, and especially his rapid recovery under iodide of potassium, point clearly to such a conclusion.

TUBERCULAR DISEASE OF THE GULLET.

This affection is characterized by the secondary deposit, in the mucous membrane of the œsophagus, of tubercles, which break down in the ordinary way and end in ulceration. It is only in comparatively recent times that this disease has been recognized. The first mention of it appears to have been made by Andral,[1] who speaks of finding tubercles beneath the œsophageal mucous membrane. Some years later a case was reported,[2] in which tubercles were found at the upper part of the gullet. In 1851 Oppolzer[3] referred to tubercle of the œsophagus as a pathological curiosity. An instance of the affection was recorded by Willigk,[4] in 1854, and ten years later Maisonneuve[5] related an example of stricture of the upper part of the gullet, caused by tubercular infiltration. In 1868 a conclusive case was published by Chvostek,[6] and a doubtful one by Paulicki.[7] Zenker and Ziemssen[8] briefly allude to two cases which "they believe could be called tubercular." One of these, however, appears to have been merely an example of caseous peri-œsophageal glands perforating the gullet. The account of the other case is so meagre that it is impossible to arrive at any independent opinion as to its nature. In both instances the microscopic examination gave only negative results. Knott[9] quotes a case which was reported to the Pathological Society of Dublin by Professor R. W. Smith. Laboulbène[10] states that he has met with two instances of the disease, of which he had unfortunately neglected to keep notes. The etiology of the disease is obscure, the well-known tendency of tubercle to become developed in various organs after its primary deposit in the lungs being manifested only to a very slight extent in the œsophagus. No satisfactory evidence of the primary occurrence of tubercle in this situation has yet been produced, though in the case quoted by Knott the dysphagia was present some months before there was any evidence of pulmonary mischief. I have myself never seen an example of the disease. It is probable, however, that it is more common than the small number of recorded cases would lead us to suppose, and I have little doubt that examples of it will be more frequently met with as the pathology of the gullet comes to be more closely studied.

[1] Précis d'Anat. Pathol. Paris, 1829, t. ii., p. 274.
[2] Würtemberg Med. Corresp. Blatt., 1844, Bd. xxiii.
[3] Wien. Med. Wochenschrift, 1851, Nos. 2, 5, and 12.
[4] Prag. Vierteljahrschr., 1854, lx. 4.
[5] Clinique Chirurgicale, Paris, 1864, t. ii., p. 410.
[6] Oesterr. Zeitschr. für prakt. Heilk., 1868, xiv., 17 and 18.
[7] Virchow's Archiv, 1868, Bd. xliv., pp. 373–375.
[8] Cyclopædia of Pract. Med., vol. viii., p. 191.
[9] Pathology of the Œsophagus. Dublin, 1878, p. 215.
[10] Nouv. Elém. d'Anat. Pathol. Paris, 1879, p. 95.

From the few cases on record this affection would appear generally to occur in middle life or old age, and it has not hitherto been met with in children. The only *symptoms* are dysphagia and odynphagia, the former being generally the more marked. In Chvostek's case the patient, a man aged forty-three, was attacked by acute pulmonary tuberculosis in April, 1865 ; pain and difficulty in swallowing came on in January, 1866, and the patient died a week or two later. Paulicki's patient began to suffer from dysphagia two months after the first signs of lung disease showed themselves, and death was very gradual.

The *pathological* changes vary greatly in different cases. In that of Chvostek pleurisy, pulmonary tubercle, and enlargement of the liver were found, but there was no intestinal ulceration. The mucous membrane of the gullet was smooth and unbroken at the upper part, but downward from the level of the third dorsal vertebra there were numerous ulcers of various shapes with sharp-cut edges. In some instances the ulcers had a smooth, in others a villous, base of dark gray color. Over their surface were scattered whitish-yellow nodules, from some of which a thick yellowish purulent fluid could be squeezed out. The character of the ulcers in this instance was established microscopically by Professor Engel, while in Paulicki's case the tubercular origin of the œsophageal lesions was rendered probable by the history of the disease, although microscopic examination failed to prove it. Here, together with signs of old pleurisy, a suppurating cavity was found in the left, and some caseous deposits in the right apex. In the gullet, at the level of the cricoid cartilage, there was a stricture ; and on the posterior wall were two ulcers, one of them being half an inch in length and reaching through the entire depth of the mucous membrane, which was congested for some distance round.

The *diagnosis* of this affection from cancer of the œsophagus must rest chiefly on the fact that the dysphagia is not regularly progressive ; there is probably, too, in most cases, abundant evidence of tubercular deposit in the lungs. The fact that malignant disease of the gullet occasionally coexists with tubercle of the lungs must not, however, be forgotten, and hence, even when there is undoubted evidence of pulmonary phthisis, it cannot be absolutely determined that the œsophageal disorder is of similar nature.

As the disease has not hitherto been detected during life, nothing can be said as regards *prognosis*. The affection can only be *treated* symptomatically ; if there be much pain in swallowing, hypodermic injections of morphia should be given.

DILATATIONS OF THE GULLET.

(Synonyms : Diverticula. Pouches.)

Latin Eq.—Dilatationes œsophagi.
French Eq.—Dilatations de l'œsophage.
German Eq.—Erweiterungen der Speiseröhre.
Italian Eq.—Dilatazioni del esofago.

Definition.—Sacculated protrusions from the œsophageal canal, or uniform expansion of its walls, giving rise to dysphagia and regurgitation of the ingesta.

History.—Blasius [1] described, under the name of "double stomach," what, from his own report, and the rough drawing which accompanies it, was undoubtedly an instance of dilatation of the lower part of the gullet. A case of œsophageal pouch was referred to by Morgagni [2] in 1765 as having been described by Grashuis long before, and two years later Ludlow [3] reported his remarkable case. Isolated examples of the affection have, since then, been placed on record by Gianella,[4] Bell,[5] Purton,[6] Worthington,[7] Mayo,[8] and others. In 1840, Rokitansky [9] described an instance in which part of the œsophageal wall had been drawn outward in the course of cicatrization of a diseased lymphatic gland—a class of cases to which Zenker and Ziemssen subsequently gave the name of "traction-diverticula." In 1861 Rokitansky [10] described systematically the various kinds of dilatations which are found in the pharyngo-œsophageal canal. In 1867 an inaugural dissertation on the subject of œsophageal pouches was published by Fridberg.[11] In recent years, Zenker [12] has collected a large amount of pathological material bearing especially on the question of traction-diverticula, and the whole subject has been treated with remarkable completeness by Zenker and Ziemssen.[13]

*** Dilatations differ so widely as regards their mode of origin, situation, symptoms, course, and termination, that in dealing with them it will be found more convenient to depart from the regular plan adopted in this work, and to describe separately each form of the disease.

Simple Dilatations.

These dilatations may be either primary or secondary—the former occurring without any obvious cause, and the latter being the result of a stricture of the œsophageal canal at a lower level.

PRIMARY DILATATIONS.

These are cylindrical or fusiform in shape, generally affecting the whole length and circumference of the œsophagus, and usually attaining their maximum girth in the thoracic region about the middle of the gullet. The fact of the widest expansion occurring in this situation is probably to be explained by the greater freedom of the tube at this point from immediate pressure by the neighboring parts. In the case, however, described and figured by Blasius,[14] the dilatation was just above the diaphragm, and affected only the lower three inches of the gullet. Judging from the drawing, the dilatation must have been spheroidal in shape, measuring about four and a half inches from side to side.

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[1] Obs. med. anat. rarior., pars iv., obs. ix. Lugdun. Batav., 1711, p. 53, and Tab. vi., fig. v., Ibid., p. 113.

[2] De sed. et caus. morb., epist. xxviii., art. 18, ed. secund., Patavii, 1765, t. ii., p. 11.

[3] Med. Observ. and Inquiries, by a Society of Physicians in London. London, 1767, vol. iii., p. 85 et seq. Ludlow's letter describing the case is dated September 9, 1764.

[4] Borsieri: Istituz. di Med. Prat., cap. xxxix., § mccxix. Firenze, 1837, t. ii., p. 998, foot-note 4. The case was observed in 1782.

[5] Surgical Observations. London, 1817, vol. i., p. 64 et seq.

[6] London Med. and Phys. Journ., 1821, xlvi., p. 541.

[7] Med.-Chir. Trans. London, 1847, vol. xxx., p. 199 et seq.

[8] Outlines of Pathology. London, 1835, p. 285.

[9] Oesterr. Jahrb., 1840, Bd. xxi., p. 219.

[10] Lehrbuch d. pathol. Anat., vol. iii., p. 127.

[11] Diss. de œsophagi diverticulis. Giessen.

[12] Cyclopædia of Pract. Med., vol. viii., p. 68.

[13] Ibid.

[14] Op. cit. See also von Ammon, Die angeborenen chirurg. Krankheiten des Menschen. Berlin, 1842, p. 37, and Taf. viii., Fig. 15.

This form of dilatation is rare, and the *cause of it is probably general weakness, congenital or acquired, of the œsophageal wall in its whole circumference.* In most of the recorded examples the symptoms appear to have commenced between the ages of fifteen and twenty, but it is probable that in many of these cases the predisposing local weakness had existed since birth. One example of feeble development has been observed by Zenker,[1] in which simple dilatation of the gullet occurred in a seven months' child which died on the seventh day after birth. Klebs[2] has reported a case of dilatation which he supposed to be due to atony of the walls of the tube. Spengler[3] has recorded an example in which the first symptoms came on after swallowing a very hot dumpling which was temporarily arrested in the gullet. Purton[4] has reported a case in which the affection developed after a blow on the chest, and a similar instance is related by Hannay.[5] An example of the disease is mentioned by Oppolzer,[6] in which the patient had taken large quantities of warm water to relieve gout. Although it is not at all impossible that in this case mechanical dilatation may have been effected in the manner described, it is much more likely, as Knott[7] suggests, that a gouty condition of the muscles of the œsophagus diminished their power of resistance, and thereby favored dilatation.

The most prominent *symptom* exhibited by patients laboring under this affection is the regurgitation of food some hours after it has been swallowed. The matters thus returned are alkaline or neutral in reaction, and if starchy food has been taken, they have a sweetish taste. They present no *digestive* alteration, however long they may have been retained; thus in a case reported by Delle Chiaje,[8] coffee was thrown up four or five days after it had been swallowed without having undergone any change whatever. There is generally a greatly increased secretion of saliva, which the patient has continually to spit out. In Worthington's case a pint and a half of fluid was frequently voided from the mouth in the course of twenty-four hours. There is usually also some dysphagia.

The patient's breath is in most cases fetid, owing to the decomposition of the food which remains in the gullet. Sometimes there is an agonizing feeling of distention, from which relief can only be obtained by vomiting. Occasionally there is a sensation of heat or burning throughout the gullet. When the dilatation affects the thoracic portion of the tube, the distended œsophagus may, by pressure on the heart, give rise to fainting and to symptoms similar to those of angina pectoris. In Davy's[9] case there was a pulsation resembling that of an aneurism, together with considerable pain and tenderness on pressure. There was also marked dulness on percussion. This patient was only able to swallow in a semi-recumbent position, with his right arm over the back of a chair; in any other posture deglutition was impossible, and the attempt was accompanied by a sense of suffocation which gave rise to violent attacks of coughing.

A bougie can be passed only in certain cases, the possibility of doing so probably depending on whether the œsophagus remains of normal length, or whether, becoming stretched, it is doubled upon itself.

The progress of the disease is generally slow, lasting from five to ten

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[1] Op. cit., p. 51.
[2] Quoted by Zenker: Ziemssen's Cyclopædia of Pract. Med. English Transl., vol. viii., p. 47.
[3] Wien. Med. Wochenschr., 1853, No. 25.
[4] London Med. and Phys. Journ., 1821, xlvi
[5] Edin. Med. and Surg. Journ., July, 1833.
[6] Wien. Med. Wochenschr., 1851, Nos. 2, 5, 12.
[7] Op. cit., p. 21.
[8] Il Progresso. Napoli, 1840.
[9] Med. Press and Circular, May 5, 1875.

years, or even more. Indeed, in some cases sufficient food always reaches the stomach, and there is no wasting. A very remarkable case, however, has been recorded by Dr. Ogle,[1] in which great emaciation resulted, not only from the difficulty of swallowing, but more especially from the pressure of the dilated portion of the gullet on the thoracic duct.

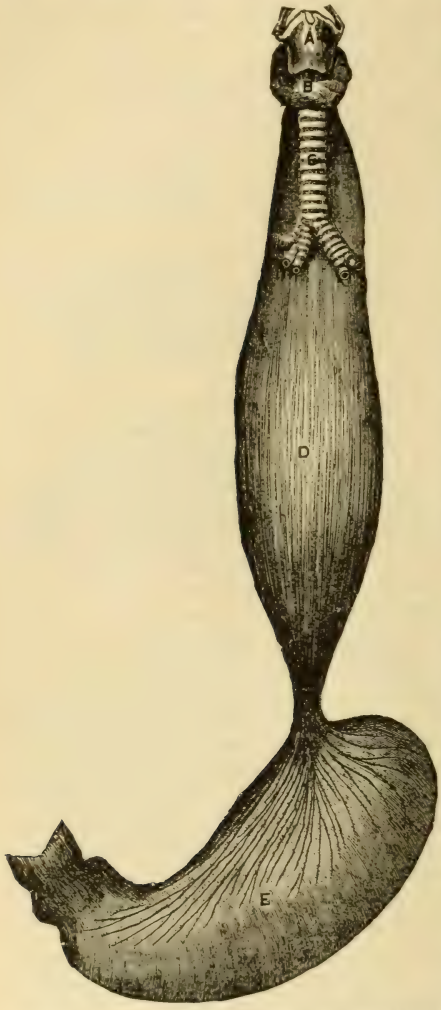

FIG. 15.—Luschka's Case of Dilated Œsophagus (after Cohen). A, the thyroid cartilage; B, the thyroid body; C, the trachea; D, the œsophagus; E, the stomach.

In the cases now under consideration, *after death* the calibre of the œsophagus is found to be greatly enlarged, the dilatation being generally somewhat spindle-shaped. In Luschka's[2] case (Fig. 15) the œsophagus was forty-six centimetres in length and thirty centimetres in circumference at the widest part. From the extreme length of the organ in this instance, it is clear that during life it must have been doubled upon itself. In these cases the muscular fibres over the affected part are greatly hypertrophied, the submucous tissue and the mucous membrane being thickened, while the latter is almost invariably congested, and frequently presents patches of ulceration. Occasionally, hemorrhagic spots are seen, and the papillæ are often much enlarged.

The *diagnosis* of this condition may be assisted by the exclusion of the various other causes of dysphagia, but can only be arrived at with certainty when, while unaltered food is regurgitated some hours after it has been swallowed, a large bougie can be easily passed down the gullet.

The *prognosis* as regards cure is exceedingly unfavorable, but by selection of suitable food the patient's life may be prolonged for many years.

The *treatment* must consist in the use of bland liquid food, taken at frequent intervals and in small quantities. If alcohol be indicated by the weak condition of the patient, it should be given in a very dilute form.

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[1] Trans. Path. Soc., London, 1866, vol. xvii., p. 142.
[2] Virchow's Archiv., 1868, Bd. xliii., p 473 et seq.

SECONDARY DILATATIONS.

These are *always the result of obstruction.*

Although writers on stricture of the gullet frequently describe dilatation as existing above the narrowed part, this condition is, in fact, extremely rare. Among the very large number of cases of cancer of the gullet which I have examined, I have not met with a single example of secondary dilatation. Wilks and Moxon[1] state that they have not seen much of the condition, and suggest as reasons for the rarity of its occurrence that in such cases little or no food is taken, and that if the disease is malignant, its course is usually too rapid for a dilatation to have time to form. A few well-marked instances of secondary dilatation have, however, been recorded. Monro[2] speaks of having found it in cases where the gullet had been for a long time obstructed by an impacted foreign body, or "by any other cause." Cruveilhier[3] has given a drawing of a case in which the gullet was narrowed at its lower part and dilated above. Lindau[4] has described an example which he met with in a man aged thirty, who was suddenly seized with difficulty in swallowing; after a time the food began to be regurgitated, and the patient died of exhaustion rather more than a year after the onset of the complaint. The gullet was found dilated in its whole length, but chiefly at its middle part, where it measured eleven centimetres across. Around the cardiac orifice was a rigid band, the exact structure of which is not described; this ring narrowed the opening, but had not prevented the passage into the stomach of a sponge probang during life. In the dilated portion was found one kilogramme ($2\frac{1}{5}$ lbs.) of pultaceous fluid, acid in reaction, and horribly fetid, composed of mucus, coagulated albumen, and altered blood. The mucous membrane was almost completely stripped off. The muscular coats were greatly stretched over the expanded portion, the longitudinal and circular fibres being separated so as to give them the appearance of forming a wide-meshed network. Watson[5] refers to a preparation showing dilatation of the gullet above a cancerous stricture of the cardiac orifice of the gullet. Gradenwitz[6] has related a remarkable instance in which the œsophagus of a man who had suffered from difficulty in swallowing for forty-three years was found thickened and contracted at the lower part, and dilated above. He had been in the habit of making the food, which accumulated above the narrowed part, pass into the stomach by stretching himself, when it could be heard to go down with a loud gurgling noise. In a case of syphilitic stricture described by West[7] the constricted portion occupied two inches and a half of the œsophagus about its middle, and was so narrow as barely to allow a No. 4 catheter to go through; above this point the gullet was much dilated. In 1877 a case was reported by Nicoladoni[8] in which the patient, a girl aged four, had swallowed lye two years before she came under notice. Œsophagostomy was done with a fatal result, and after death the gullet was found narrowed for about eight centimetres at its middle. Above the point of stricture the

[1] Morbid Anatomy of the Human Gullet, etc., Edinburgh, 1811, p. 12.
[2] Lectures on Pathological Anatomy, London, 1875, second edition, p. 364.
[3] Anatomie Pathologique, Paris, 1835–42, livraison 38, pl. 6.
[4] Casper's Wochenschr. für die gesammte Heilkunde, 1840, p. 356.
[5] Principles and Practice of Physic, London, 1857, fourth edition, vol. ii., p. 372.
[6] Schmidt's Jahrb., 1859, vol. ci., p. 298.
[7] Dublin Quart. Journ. of Med. Science, No. 57, February, 1860, p. 86 et seq.
[8] Wien. Med. Wochenschr., 1877, No. 25.

tube was irregularly dilated for 2½ ctm., the bulging being greatest toward the front and the left side. In 1878 Gougenheim[1] described a case of œsophageal stricture, probably malignant in character, in which the gullet was dilated above the seat of disease, the walls of the expanded portion being greatly thinned. Soon afterward a good example of secondary dilatation was published by Brazier.[2] The patient was a woman, aged ninety-six, who died of cancer of the stomach. The gullet was found greatly constricted for six or seven centimetres at its lower end; above this narrowed portion was a dilatation extending some way upward, and measuring "some centimetres" across. The mucous membrane lining this pouch was sodden and pulpy, owing probably to the prolonged sojourn of food at this part. The œsophageal wall at the point of stricture was found to consist entirely of bundles of muscular fibres, so rigid as almost to suggest the idea of contraction. A case has recently been recorded by Marchand[3] in which the gullet was expanded above the situation of an epitheliomatous growth; this being the only instance among thirty autopsies collected by that writer in which such a condition was found.

Fig. 16. Wilks' Case of Supposed Congenital Stricture and Dilatation of the Œsophagus (after Knott).

A case of a different kind has been reported by Wilks,[4] in which there was a supposed congenital stricture of the cardiac end of the gullet with great dilatation of the entire organ above the point of constriction (Fig. 16), but whether the dilatation was congenital or secondary to the stricture cannot be determined. In cases of stricture of the gullet, uncomplicated by dilatation, the food, on reaching the narrow part of the canal, is usually at once returned; but should there be a dilatation above the contracted portion of the tube, the food would probably be retained for a time and afterward thrown up unchanged.

This form of dilatation may be *distinguished* from that last described by the fact that in the case of simple pouches, as already explained, there may be a difficulty in passing a bougie at one time and not at another, while if a stricture be present, the obstruction is persistent; the *prognosis* depends on the original cause of the affection, and the *treatment* must be directed to the stricture. (See Cicatricial Stricture.)

SACCIFORM DILATATIONS.

These depend on weakness of a *small portion, generally of the muscular structure, of the wall of the gullet.* They have been called "pressure-diverticula" ("Pulsions-Divertikel") by Ziemssen, owing to the fact that they are formed by *pressure* of the œsophageal wall outward.

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[1] Gazette des Hôpitaux, 1878, p. 446.
[2] Contribution à l'Étude de l'Œsophagisme, Thèse de Paris, 1879, pp. 89, 90.
[3] Néoplasies de l'Œsophage, Thèse de Paris, 1880, p. 50.
[4] Guy's Hosp. Rep., 1871–2, vol. xvii.

They vary in size from a slight bulging to a sac five inches or even more in length. They are rare, and are, in the majority of instances, situated in the posterior wall of the œsophagus, at its junction with the pharynx, and pass down between the food-tract and the vertebral column. They are, in fact, pharyngeal rather than œsophageal pouches. Most writers believe that these pouches originate in congenital weakness of a limited portion of the œsophageal wall. Although the protrusion is very slight, and perhaps inappreciable in early life, it is probable that the œsophagus gives way under some trifling pressure at a later period. Hitherto, no example of this condition has been observed in a new-born infant, or even in a child, but a case has recently been published by Féré,[1] which furnishes a possible explanation of the mode of formation of some œsophageal pouches. Although in this instance the deficiency of tissue was not in the situation where a pouch is usually formed, but at a spot precisely in the middle of the anterior wall of the gullet, the case has a direct bearing on the point under consideration. The muscular coat was found to be wanting over a space one millimetre square, and about one centimetre below the upper end of the œsophagus. Even with the microscope no trace of muscular covering could be seen in this place. The borders of the space were thickened, and the interval was filled up by areolar tissue mingled with some elastic fibres. The congenital absence of the muscular covering at any point would, it need scarcely be remarked, greatly favor the development of a pouch. Billroth,[2] however, who had recorded an instance in which a pouch on the left side of the gullet was covered, not only by the mucous membrane, but by the proper muscular investment of the tube, suggests that such diverticula have their origin in a branchial fissure, the internal orifice of which remains patent, while the external outlet has become obliterated in the normal way. Cases are more often met with in men than in women. In twenty-nine cases collected by Zenker and Ziemssen [3] in which the sex is stated, there were but two women, and in both of them the origin of the affection was apparently traumatic. According to the same authors,[4] the disease most commonly begins after the fortieth year, and they explain the special predisposition of males, and the age at which the disease occurs, by the ossification of the cricoid cartilage, which, it is well known, is much more frequent, and comes on at an earlier age in men than in women.

Zenker and Ziemssen [5] point out that the muscular investment of the pharynx is weaker near its junction with the gullet than at any other part of the pharyngo-œsophageal canal, for where the lower fibres of the inferior constrictor muscle become continuous with the upper circular fibres of the œsophagus there is a triangular space left covered only by the transverse fibres of the constrictor. Owing to the narrowness of the tube just below this, and the comparatively unyielding wall formed in front by the back of the cricoid cartilage, a hard morsel of food or a foreign body is likely to be driven against the posterior wall. A depression thus made is liable to be constantly enlarged by the pressure of descending food, and the pouch, which mainly consists of mucous membrane protruded between the muscular fibres, has no power of emptying itself by contraction of its contents. As it becomes larger it pushes the corresponding part of the œsophagus slightly forward, and subsequently the food, in descending,

[1] Progrès Médical, 1879, vii., p. 227.
[2] Clinical Surgery, Syd. Soc. Transl., London, 1881, p. 130.
[3] Ziemssen's Cyclopædia of Pract. Med., English Transl., vol. viii., p. 64.
[4] Op. cit., p. 65. [5] Ibid., p. 59.

tends to pass into the diverticulum, instead of going down the normal canal. Further, as the pouch becomes full, resistance to its distention in a backward direction is offered by the vertebral column, and consequently the sac presses anteriorly on the œsophagus, and sometimes closes it completely. A good illustration of this form of compression is shown in the annexed drawing of a case (Fig. 17) reported by Dr. Ogle.[1] For many years the patient had suffered from extreme dysphagia, which was supposed to be due to stricture of the tube. Cases originating in the manner above described have been published by Ludlow,[2] Dendy,[3] and Kühne.[4] Gassner[5] records an instance of the affection in which an officer received a severe injury to his neck in a fall from horseback, which gradually resulted in the formation of an œsophageal pouch, which ultimately caused his death. In a case reported by Waldenburg[6] the patient ascribed the origin of the condition to his having been throttled, while in another described by Klose[7] the supposed cause was the impaction of a fish-bone. Bücking[8] has related an example (which, however, was not verified by post-mortem examination) in which the affection was ascribed to wearing too tight a necktie. I have recently met with a case (see Cicatricial Stricture) in which a small pouch 2½ ctm. in length and 4 mm. in diameter resulted from the swallowing of a strong alkaline solution. The sac was situated about 7 ctm. above the cardia. Half of it was really a fistulous passage between the muscular coats, but the lower portion, which projected obliquely downward and was covered with muscle, was a true pouch. The sac communicated with the œsophagus by means of three small openings (see Fig. 20, *d*). It probably became developed in the following manner: The caustic solution caused an ulcer in which particles of food lodged; further swallowing drove the first particles—possibly some gritty substance—more deeply into the wall of the gullet, which finally was itself pushed out.

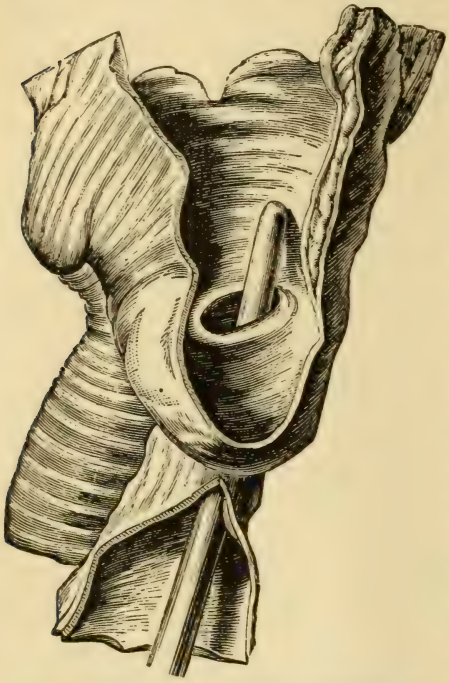

FIG. 17.—Ogle's Case of Sacciform Dilatation of the Œsophagus (after Knott).

The *symptoms* are at first so slight as not to attract much notice. They consist chiefly in the temporary retention of small fragments of food. It

[1] Trans. Path. Soc., London, 1866, vol. xvii., p. 141.
[2] Loc. cit. [3] Lancet, June, 1848.
[4] Froriep: Chirurgische Kupfertafeln, Weimar, 1820–1847, Taf. 392.
[5] Fridberg: Diss. de œsophagi diverticulis. Giessen, 1867.
[6] Berlin Med. Wochenschr., 1870, No. 48, p. 578.
[7] Günsburg's Zeitschr. für klin. Med., 1850, Bd. i., p. 344.
[8] Baldinger's Neues Magazin für Aerzte, 1781, Bd. iii., p. 242.

is only when the diverticulum enlarges and begins to press on the gullet that medical advice is sought. Owing to the situation of the pouch, when it attains any size it is always visible in the neck at the side of the larynx. The swelling may be unilateral or bilateral. It is often impossible to pass a bougie, but it sometimes happens that it can be pushed down one day and not the next, the possibility of introducing the instrument depending on the fulness or emptiness of the sac. As a rule, when this is full the œsophageal canal is pressed upon and the bougie cannot be passed, but sometimes, when the sac is of moderate dimensions, its temporary distention by food prevents the sound entering the abnormal cavity and permits it to traverse the normal canal. In an instance reported by Belz [1] a loud splashing sound could be heard on pressing over the episternal notch. As the sac increases in size a considerable quantity of food lodges in it, and this is from time to time regurgitated in a manner somewhat resembling rumination. After a time the patient may gradually waste, and actually perish from inanition. In many cases, however, death has not taken place till an advanced age.

The *pathology* of these cases is very simple. The pouch, as already remarked, almost invariably forms at the junction of the pharynx with the œsophagus, and as it increases in size it usually becomes pyriform in shape. The lining membrane of the sac generally shows signs of chronic inflammation. The mucous membrane and the *submucosa* are very much thickened, the surface of the former being sometimes covered with papillary growths. Zenker and Ziemssen [2] maintain that *the sac has no muscular covering except at its neck*, but in Worthington's case it is stated that "nearly the upper two-thirds were covered with muscular fasciculi derived from the pharyngeal constrictors, the fibres of which were unusually developed," and in Billroth's case, as already pointed out, the sac had a complete muscular covering. The disease does not seriously shorten life, for out of nineteen cases collected by Zenker and Ziemssen,[3] in which the age is given, death took place as follows:

	Deaths.
Between the ages of 40 and 50	2
" " 50 " 60	3
" " 60 " 70	8
" " 70 " 80	5
At the age of 80	1
	19

These authors further point out that the progress of the disease is generally very slow, and that in many cases it is reported to have lasted from twenty to thirty years, and in one instance for forty-nine years.

The brief remarks made under Simple Dilatation as to diet and treatment apply here.

Traction-Diverticula.

The peculiarity of these diverticula is that the *cause of them is altogether external to the œsophageal wall.*

This form of dilatation is relatively common, and is generally found on

[1] Schmidt's Jahrb., 1873, Bd. clx., p. 183.
[2] Op. cit., p. 57.
[3] Op. cit., p. 64.

the anterior wall of the œsophagus, most frequently at a point either opposite or very near to the bifurcation of the trachea. These diverticula are generally, but not invariably, conical in shape, the broad base corresponding to the œsophageal wall, and the apex directed horizontally forward or even upward. The disease probably begins in childhood, and it seems to affect both sexes in nearly equal proportion. Out of 54 cases collected by Zenker and Ziemssen,[1] 29 occurred in men and 25 in women. The sacs vary in size from two to eight millimetres, but occasionally they measure as much as twelve millimetres from the base to the apex; indeed, in the case reported by Fridberg,[2] the pouch was one inch and a half long.

Traction-diverticula appear to originate most commonly in scrofulous disease of the lymphatic glands, which are so abundant about the bifurcation of the windpipe. The inflammation spreads from the gland to the peri-œsophageal areolar tissue, and sometimes reaches even the muscular coat: subsequently, fibroid or calcareous degeneration of the gland takes place, followed by cicatricial contraction, and it is by the latter process that the wall of the gullet is drawn out and a sac formed. In some instances the suppuration of a scrofulous gland appears to have produced direct ulceration of the œsophageal wall, and in such cases the altered gland-structure forms the outer covering of the diverticulum. It is probable that these are the cases in which the conical form is not preserved. Vertebra caries has sometimes led to the formation of pouches.[3] The disease occasionally seems to originate in the trachea from the inhalation of gritty particles, which by setting up disease in the respiratory passages may ultimately lead to the peri-œsophageal contraction.

As far as I am aware, this form of diverticulum never gives rise to any symptoms during life. It is just possible that in some cases the orifice of the sac might be seen on the anterior wall with the œsophagoscope. The opening is generally exceedingly black, and the mucous membrane around it puckered, and if it came within the range of the mirror it could not be mistaken.

The form and size of traction-diverticula have already been described, and it now only remains to be observed that in those cases in which the fundus of the diverticulum has ulcerated, disease of adjacent organs is often noticed after death. In such instances a dark-colored fluid and occasionally portions of food are found within the sac; and Rokitansky[4] has reported a case in which a small flat piece of bone was met with, which was supposed to have given rise to a perforation at the distal end of the diverticulum. In such cases a fistulous tract may even extend to the pericardium, the pleural cavity, or the apex of one of the lungs, where it is sometimes in communication with a previously existing vomica. The most frequent course of the fistula, however, is into one of the bronchi. The passage of small particles of food or portions of ichorous matter into the bronchial tubes may give rise to bronchitis, pneumonia, or even gangrene. The fistula may cause instant death by perforation of the aorta, as in a case observed by G. Merkel,[5] but this is a very rare phenomenon.

As the disease has not hitherto been recognized during life, the question of prognosis does not come within the domain of practical medicine. No treatment is likely to be of any avail, and should the complaint be sus-

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[1] Op. cit., p. 64. [2] Op. cit.
[3] Zenker and Ziemssen: Op. cit., p. 75, foot-note 1.
[4] Lehrb. d. pathol. Anat., Wien, 1861, p. 38.
[5] Ziemssen's Cyclopædia, vol. viii., p. 81.

pected, all that the physician can do is to recommend a soft and non-irritating diet.

The following is a good illustration of traction-diverticulum which recently came under my notice:

In the gullet of a man aged fifty-three, a pouch was found, of which the annexed woodcuts give a good representation (Figs. 18 and 19). It was situated at the junction of the anterior and left walls, the opening being vertical in direction, and irregular from puckering of the mucous membrane. The aperture was from four to five millimetres wide and nineteen in length, its upper end being rather more than nine centimetres below the lower rim of the cricoid cartilage. The diverticulum was large enough

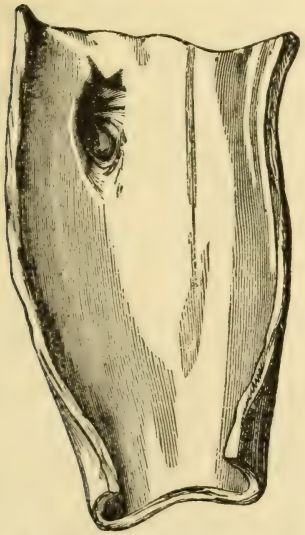

FIG. 18.—The Gullet laid open, showing the pouch as seen from the inside.

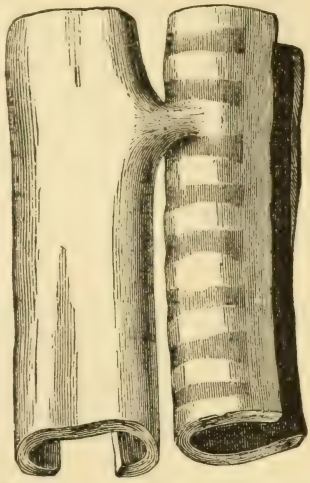

FIG. 19.—Portions of the Œsophagus and Trachea about three and a half inches below the level of the cricoid cartilage, showing adhesion between the wall of the gullet and the windpipe at one point.

to admit the tip of the little finger, and extended inward for eleven millimetres at the deepest part. The lining membrane was perfectly healthy but much puckered. The direction of the pouch was horizontally forward to the trachea, into which the fibres were inserted by a quasi-aponeurotic band of thickened areolar tissue. The attachment was about a quarter of an inch in breadth, and joined the posterior wall of the trachea to the left of the middle line—that is to say, altogether on the cartilaginous part of the air-tube; the insertion of the pouch was more or less vertical in direction, corresponding to the intra-œsophageal opening, but with a distinct inclination downward and inward. External to the pouch were some enlarged glands, and it was surrounded, especially near the tracheal extremity, by a good deal of thickened tissue. No symptoms traceable to this condition had been noticed during life. The patient died from cancer of the gullet, but the malignant disease was at the upper part of the tube, and did not approach nearer than from two to three centimetres to the pouch. No connection could be discovered between the two affections, and, as far as could be judged from the appearance of the surrounding tissues, the diverticulum was long antecedent to the carcinomatous growth.

CICATRICIAL STRICTURE OF THE GULLET.

Latin Eq.—Coarctatio œsophagi a cicatrice.
French Eq.—Rétrécissement cicatriciel de l'œsophage.
German Eq.—Narbige Strictur der Speiseröhre.
Italian Eq.—Strettura cicatriciale del esofago.

Definition.—Diminution of the lumen of the œsophagus caused by contraction of the cicatrix of a previously existing ulcer or wound, giving rise to severe dysphagia, and often to death by starvation.

History.—The ancient physicians had probably no acquaintance with traumatic stricture of the gullet, for in those days the strong acids and the weak alkaline solutions, now so largely used in the arts and for household purposes, were confined to the alchemist's laboratory. Œsophageal stricture, however, arising from the healing of syphilitic or variolous ulcers [1] did not escape the notice of the earlier writers. (See Syphilis of the Gullet.) Cicatricial contraction was distinctly recognized by Beutel[2] as a possible cause of narrowing of the œsophageal canal, and it was also mentioned by Morgagni.[3] At a later period, cases of injury to the œsophagus from corrosive solutions, followed by stricture of its channel, were related by Charles Bell,[4] Cumin,[5] Dewar,[6] Syme,[7] Gendron,[8] Bayle and Cayol,[9] Wolff,[10] and Béhier.[11] In 1862 Keller[12] reported a number of cases occurring in young children, while quite recently Wolzendorff [13] has published ninety-one examples of the affection collected from various sources.

Etiology.—Cicatricial stricture of the gullet may result from any disease or injury in which ulceration is followed by healing. The most common cause of these contractions is probably to be found in the swallowing of weak alkaline solutions, especially soap-lees, but occasionally they are due to the action of concentrated poisons (see Traumatic Œsophagitis). Most of the patients in this country are adults, but abroad the accident appears to be not unfrequent among children and even infants, Keller having reported no fewer than forty-five cases met with in children between twelve and fifteen months old. Contraction also sometimes arises from the temporary impaction of a foreign body producing an ulcer which ultimately cicatrizes. Leroux[14] mentions a case in which the narrowing followed the swallowing of very hot liquid containing a piece of leek. A most interesting case has lately been related by Dr. Kendal Franks,[15] in

[1] Two cases have been related (Brechfeld: Ephem. Natur. Curios., 1671, p. 182; Lanzoni: Ibid., Ann. ii., Obs. ix., t. xlv., p. 80) in which obstruction appears to have been due to the agglutination of the opposite sides of the gullet from ulceration consequent on variolous pustules. The affection, however, is so extremely rare that it has not been thought necessary to treat of it in a separate article.

[2] De strumi œsophagi. Tübingen, 1742.

[3] De sed. et causis morb., ed. secunda, Patavii, 1765, ep. xxviii.

[4] Surgical Observations, 1817, vol. i., p. 80.

[5] Trans. Edin. Med.-Chir. Soc., 1827, vol. iii., p. 600, etc.

[6] Edin. Med. and Surg. Journ., vol. xxx., p. 310, etc.

[7] Ibid., October, 1836.

[8] Journ. des Connaissances Méd.-Chir., 1837.

[9] Dict. en 60 volumes, t. iii., p. 615.

[10] Archiv. Gén., 1853, t. ii., p 490.

[11] Conférences de Clinique Médicale, Paris, 1864, pp. 113–117.

[12] Œsterr. Zeitung für prakt. Heilk., 1862, Nos. 45–47. Keller's cases have already been referred to under Traumatic Œsophagitis.

[13] Deutsche Militärärztl. Zeitschr., 1880, p. 477.

[14] Cours sur les Généralités de la Médecine Pratique, Paris, 1825, t. i., p. 315.

[15] Med. Press and Circular, April 19, 1882, p. 335.

which gradually increasing dysphagia had followed the impaction of a hard piece of bread-crust. When the patient, a girl, aged twenty, was first seen by Dr. Franks, the affection had existed for four years and a half, and she was much emaciated. There was no evidence of hysteria, and I think there can be no doubt that the stricture was due to cicatricial thickening at the place where the gullet had been injured by the rugged edge of the crust at the time of the accident.

Symptoms.—The characteristic symptom of cicatricial stricture of the œsophagus is dysphagia, which in general terms may be said to vary in degree according to the amount of narrowing of the canal. Sometimes, however, though the actual organic obstruction may be slight, deglutition is rendered difficult by superinduced spasm. Where the contraction results from the swallowing of *a weak caustic or irritant solution*, there is generally, at the commencement, an inflammatory period, during which there is great dysphagia and often odynphagia; these symptoms persist as long as the ulceration continues, but when the ulcer heals the patient can usually swallow with ease, and for some time may consider himself cured. At the end of a few months, however, owing to the contraction of the tissue forming the cicatrix, difficulty in swallowing is again experienced. From this period the dysphagia generally grows steadily worse, and if not relieved, is extremely likely to prove fatal. In cases where the poison has been *a strong caustic*, the dysphagia does not pass off at all, or only subsides for a few days, and soon again becomes urgent. Thus in a case reported by Fugier,[1] after the expulsion of a large mass of membrane, liquids passed easily, but this improvement only lasted for twelve days, when it became impossible for the patient to swallow nourishment of any kind. The course of cicatricial stricture resulting from disease is very similar to that arising from accidental injury, for the dysphagia from which the patient suffers while the ulcer is open, passes off as the surface heals, and again causes trouble after cicatrization.

The *position* of the stricture may be ascertained by auscultation, or by the passage of a bougie. On listening over the course of the œsophagus posteriorly it will be noticed that fluids pass at the ordinary rate and give rise to the normal sound till they reach the upper part of the stricture, when the fluid is partially arrested, and a gurgling or trickling noise is perceived below the point of obstruction. The latter phenomenon may be observed to continue for three, four, or even five minutes after a mouthful of fluid has been swallowed. On using the bougie, the instrument is either arrested at the point of obstruction or is passed beyond it with difficulty. Sometimes a second stricture may be found[2] lower down, while occasionally even three strictures are present.[3]

Diagnosis.—As a rule, in the traumatic cases, the diagnosis presents no difficulty, the history of an irritant poison having been swallowed at once removing all doubt. It is only in very rare instances—where, for example, the temporary lodgment of a foreign body, or the fact of an irritant having been swallowed in early life has been forgotten, or where a caustic poison having been taken suicidally the patient is unwilling to confess the circumstance, or where an insane person is the subject of the stricture—that any question can arise. Under such exceptional circumstances it will be necessary—first, to determine whether the difficulty of swallowing be due

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[1] Des Rétrécissements de l'Œsophage, Thèse de Paris, 1877, p. 20.
[2] Bull. de la Soc. Anat., 1841, p. 170.
[3] Basham: Med. Chir. Trans., vols. xxxiii. and xlv.

to *stricture* or to *compression* of the œsophagus; and, secondly, in the event of the affection being intra-œsophageal, to eliminate the various other diseases of the gullet. In cases of compression, the difficulty of swallowing, though considerable, is seldom so marked as in cicatricial stricture, except in certain rare instances of fibrous or cancerous enlargement of the thyroid gland, or of tumor in the posterior mediastinum. In aneurism of the arch of the aorta, and enlargement of the cervical or bronchial glands, as well as in peri-œsophageal abscess, the difficulty in swallowing is seldom so extreme or so constant. The morbid conditions, moreover, which cause dysphagia by compression are in most cases sufficiently obvious to be at once recognized. They will be again referred to in the article on Compression of the Gullet.

The only diseases of the œsophagus itself which require to be differentiated from cicatricial contraction are cancer and simple stenosis. Malignant disease may be recognized by its usual occurrence in persons over forty years of age, and by its progressive character, the dysphagia generally attaining its full intensity in the course of a few months. The special, though not invariable, characteristic of true cicatricial stricture, on the other hand, is the peculiar character of the dysphagia—that is to say, its primary occurrence, its disappearance, and its subsequent return in a more severe and intractable form. In cases of simple stenosis there is a history of difficulty in swallowing from an early period of life, and the symptom is not progressive. Where cicatricial stricture results from the healing of an ulcer caused by disease, a clear history of the previous existence of the constitutional complaint can alone establish the diagnosis.

Pathology.—The stricture in traumatic cases nearly always occupies two or three inches of the gullet, and may occasionally involve its entire length. In a case reported by Czerny,[1] cicatricial tissue replaced the normal structures throughout the lower third of the tube. In one of my cases (Sarah C.), hereafter reported, the stricture extended from within half an inch of the cricoid cartilage to within an inch of the cardia. In nearly every instance the walls of the œsophagus are considerably thickened. The lumen of the canal is generally very much narrowed, and sometimes, as in a case related by Horsey,[2] absolutely obliterated, the gullet being represented by a dense fibrous cord. The lining membrane presents considerable variety of appearance, for sometimes long vertical folds are met with, which during life, no doubt, meet in the centre of the canal, or even interlock in such a way as completely to occlude the passage. Sometimes there are transverse bands, and not unfrequently a rough reticular structure is found formed by short fibrous ridges running in every direction, while occasionally a quasi-cribriform appearance is produced by the presence of a great number of small, deep excavations. In nearly all cases there are some smooth indurated patches where the mucous membrane has been replaced by cicatricial tissue. Although dilatation of the œsophagus above the seat of stricture is not generally observed in cases of cicatricial contraction, still it has been occasionally met with.[3]

Prognosis.—The prospects of the patient depend a good deal on the strength of the irritant solution which has been swallowed. For this reason, in suicidal cases where strong mineral acids are usually taken, extensive and intractable cicatrices are much more likely to be present than

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[1] Beiträge zur Operativen Chirurgie, 1878, p. 70.
[2] Amer. Journ. Med. Sci., 1876, New Series, lxxii., p. 114.
[3] See Dilatations of the Gullet.

where patients have accidentally swallowed solutions of soap-lees. It may, however, be laid down as a general rule that cicatricial stricture is always attended with considerable danger, for not only is it often exceedingly difficult to effect dilatation, but even in cases where some degree of expansion has been produced, subsequent contraction is likely to take place unless the use of bougies is regularly persevered with. Many instances of cure, however, have been reported. The most successful series is that of Keller's[1] 35 cases, of which 23 were cured, 3 benefited, 5 died (one of them from gangrene of the lungs), and 4 remained under treatment at the time of the report.[2] When it is remembered that in all these instances the patients were infants under two years of age, the success of the treatment is all the more remarkable, and must indeed be regarded as quite exceptional. It is probable that in many of these cases the obstruction was due rather to inflammatory thickening and induration than to actual cicatrization. Out of 75 cases of which details are given by Wolzendorf,[3] 23 proved fatal.

Treatment.—Medical treatment is of little use, but, as is shown by the above figures, surgery claims many cures. More often, however, all that can be done is to prolong life. The following are the various methods of combating the local condition: 1, gentle dilatation; 2, forcible dilatation; 3, internal œsophagotomy; 4, œsophagostomy; and 5, gastrostomy.

Gentle dilatation is the method by which the largest number of cases have been cured, but it is obvious that its success is likely to be greatest where the disease is slight and recent, and more especially in those cases which, though originating in the same way as true cicatricial stricture, and scarcely to be distinguished therefrom in their clinical history, strictly belong to the class of indurations. Dilatation is best effected by passing bougies of gradually increasing diameter. The mode of using these instruments has already been described (p. 9). Where there is obvious difficulty in swallowing, a No. 6 (Author's scale) should first be tried, and if this will not pass, a smaller instrument must be employed. As the passage of the bougie often provokes coughing and a considerable flow of saliva and mucus, the patient should be made to bend forward in order that the secretion may fall easily into a hand-basin. The bougie should, if possible, be left in position on the first occasion for five minutes, and as the patient gets accustomed to its use he may be able to tolerate it for ten or twenty minutes or even for half an hour at a time. The operation may be repeated twice a week, and in some cases on alternate days. Very few patients can bear the daily passage of the instrument. The same size of bougie should be passed on at least two occasions, and generally it is better to use it three or four times before a larger one is employed. Some surgeons, after withdrawing a bougie, immediately try to pass a larger one, under the impression that an instrument of greater size can by this means be more easily made to traverse the stricture. I have not found this to be the case, but on the contrary it has appeared to me that the passage of one bougie generally gives rise to a slight amount of congestion, which renders it difficult to introduce a second one at the same sitting. In adults it is unnecessary to dilate the œsophagus beyond the size of No. 15 (Author's scale), while for children under twelve bougies

[1] Loc. cit.

[2] Keller reports 46 cases of traumatic œsophagitis caused by swallowing soap-lees, but 8 of these were slight cases, in which no stricture resulted, and 3 died soon after the accident.

[3] Loc. cit.

larger than No. 8 should not be used, and for those between twelve and sixteen years of age the maximum size should be No. 12.

I formerly attempted to dilate cicatricial strictures by means of oversliding catheters—that is to say, by first passing a whalebone bougie, and then running over it a catheter finely tipped with metal; but though I tried a great variety of instruments, I found that, owing to the relaxed condition of the walls of the œsophagus, the catheter was so often caught in the folds of the mucous membrane that I was obliged to give up this method.

Forcible Dilatation.—My experience of forcible dilatation has not been satisfactory. In 1862 and the following year I had several instruments made,[1] and I had an opportunity of using them in four cases of cicatricial stricture, but though I did not meet with any accident, I found it extremely difficult to apply the dilating force at exactly the right spot, and also to regulate the degree of expansion. Some of these cases, which appeared to be cured[2] at the time, relapsed after a few months, and I ultimately abandoned the method altogether. Quite recently, however, Dr. Kendal Franks[3] has been more fortunate, and in the case already alluded to under Etiology, he succeeded in effecting the cure of a fibrous stricture by rapid stretching with Otis' dilating urethrotome followed by the regular passage of bougies.

Of the remaining operations, internal œsophagotomy, œsophagostomy, and gastrostomy, the two latter have been performed much more frequently for cancerous than for cicatricial stricture, not because the results in the former condition promised to be more favorable, but because cancer of the gullet gives rise to obstruction much more often than any other affection. It has therefore been thought desirable to consider these two operations irrespectively of the special lesion for which they have been undertaken.

Internal Œsophagotomy.—Strictures may sometimes be cut through by means of an instrument introduced through the narrowed portion of the gullet.

History of the Operation.—To Maisonneuve[4] belongs the credit of first attempting to relieve cicatricial stricture of the gullet by internal incision. He operated on three cases, of which two died and one recovered. In the two fatal cases the patients were women, and succumbed to peritonitis, which Maisonneuve believed to have been set up by the operation in consequence of a special sympathy which he assumed to exist between the gullet and the peritoneum. In a fourth case, in which the same surgeon attempted internal œsophagotomy, the patient's death was due to a false passage which was made into the posterior mediastinum. Lanelongue[5] soon afterward operated successfully. Dolbeau[6] performed the operation on two patients, both of whom appeared to be cured as long as they continued under observation. Trélat[7] had a good result from the procedure in spite of severe primary and secondary hemorrhage. Tillaux,[8] Studsgaard,[9] and Schilz,[10] have each reported a successful case. The last-

[1] By Krohne Sesemann.

[2] See a report of one of these cases in the Transactions of the Clinical Society, 1870, vol. iii., pp. 181, 182, where also a description of the instrument which I used may be found.

[3] Loc. cit., p. 335.

[4] Clinique Chirurgicale, Paris, 1864, t. ii., p. 409.

[5] Mém. de la Soc. de Chir. de Paris, 1865, t. vi., p. 547.

[6] Gazette des Hôpitaux, 1870.

[7] Bull. Gén. de Thérap., 1870, t. lxxviii., p. 252.

[8] Bull. de Thérap., 1872, t. lxxxiv., p. 14.

[9] Canstatt's Jahresb., 1873, Bd. ii, p. 487; and 1875, Bd. ii., Abtheil. ii., p. 297.

[10] Correspondenz-Blatt. d. ärztl. Vereins in Rheinland, April, 1877, No. 19, p. 19.

named surgeon was less fortunate in a second instance, in which the patient died from profuse hemorrhage.[1] Czerny[2] performed the operation on a child, who died from peri-œsophageal cellulitis complicated by diphtheria. Recently cases have been treated after this method by myself and by Dr. Roe,[3] of Rochester, N. Y., the particulars of which will be found below. Dr. Elsberg,[4] of New York, has also operated successfully in two cases.

The stricture has sometimes been divided from above downward,[5] but this method is extremely dangerous, and should never be attempted. The incisions should always be made from below upward. The use of the œsophagotome (Fig. 9, p. 15) is perfectly simple. It is introduced with the blade concealed, and when the portion of the instrument containing the knife is felt to be below the stricture, the blade is to be made to project, and by a rapid upward movement of the instrument the obstructing band should be cut through. If necessary two or three incisions may be made. A week after the operation a medium-sized bougie should be passed to counteract the tendency of the divided tissues to shrink in healing, and instruments of gradually increasing size should be used from time to time.

From an examination of the results of the published cases (see History) internal œsophagotomy does not appear to be a very satisfactory operation. Of the 17 cases in which it has been practised, 4 died, *i.e.*, 23.5 per cent. This estimate includes only cases which proved fatal within fifteen days of the operation ; the mortality would doubtless appear much higher if all the cases were counted in which death, though directly traceable to the operation, did not occur within the above-mentioned period. Thus, in my own case the patient died three months after the œsophageal stricture was divided, but the pulmonary inflammation, to which he ultimately succumbed, came on so soon after the operation that it is most probable there was a causal relation between the two events.

On analyzing the statistics more closely it will be found that the operation has been done eleven times for the relief of cicatricial stricture, twice for œsophageal stenosis of an indefinite nature, once for malignant, and once for tubercular disease. Of the remaining two cases I have no details beyond the fact recorded by the operator that they were successful. Of the cicactricial cases three, *i.e.*, 27.28 per cent., died. This average, however, would be considerably reduced if each individual act of œsophagotomy were to be counted as a separate case, for the operation was performed six times on one of the patients, three times on another, and twice on a third. This would raise the total number of operations to nineteen, with a mortality of only 15.7 per cent. In the case of malignant disease intra-œsophageal section was practised five times, on each occasion with definite, though transient, benefit, and the patient finally died of phthisis. The patient with tubercular stricture died of peritonitis four days after the operation.

The *advantages* of internal œsophagotomy are :

Firstly.—That it is attended with an inconsiderable amount of shock.

Secondly.—That if the stricture can be thoroughly divided, gradual dilatation can be carried out and a cure thereby be effected.

Thirdly.—That the procedure involves no external wound requiring constant attention and giving rise to disfigurement.

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[1] Ibid. [2] Beitrage zur Operat. Chirurg., 1878, p. 70.
[3] New York Med. Record, November 11, 1882.
[4] Arch of Laryngol., January, 1883, vol. iv., No. 1, p. 56 et seq.
[5] By Maisonneuve, Lanelongue, and Studsgaard.

The *disadvantages* of internal œsophagotomy are :

Firstly.—That it can only be safely performed in cases where it is still possible to get a bougie through the stricture.

Secondly.—That owing to the formation of these strictures, which often extend far down the gullet, it is difficult to get beyond all the points of obstruction. (It may be added that in many cases of cicatricial narrowing the obstructing ridges are vertical in direction, and therefore cannot be divided by any instrument [see Fig. 20, *a*].)

Thirdly.—That in many cases the walls of the œsophagus are so much thickened that limited longitudinal incision cannot relieve the obstruction.

Fourthly.—That the actual danger attending the performance of the operation is far from inconsiderable. (Indeed, the thinness of the œsophageal walls, the close proximity of many vital organs, and the fact that in disease the gullet is often intimately adherent to the surrounding parts, constitute dangers which cannot be ignored. In one of the fatal cases death was due to hemorrhage, and in one of the successful operations bleeding occurred to an alarming extent.)

The following case illustrates cicatricial stricture :—

Henry A. drank a solution of potash on September 17, 1880, and in spite of immediate treatment at the London Hospital, his gullet became so much narrowed that thirteen weeks elapsed before he was able to swallow fish. The stricture was treated by gradual dilatation until February, 1881, when, owing to an attack of small-pox, the patient discontinued his attendance for four weeks. When seen again he could swallow nothing but jelly. He was admitted into the Hospital for Diseases of the Throat, under my care, on April 7, 1881, being by that time in an extremely weak condition. The stricture was found to begin just below the level of the cricoid cartilage, the canal of the œsophagus at the affected part being very tortuous and deviating to the left side. Gradual dilatation rendered it possible to pass a No. 8 bougie by June 2d ; but more than a month later an advance of only one size had been made. On July 12th I performed internal œsophagotomy, dividing the stricture in the middle line behind from below upward. A No. 14 bougie could then be passed without difficulty. The pain of the operation was slight, but in a few hours the patient began to feel some discomfort over the base of the right lung, and unmistakable signs of pneumonia soon afterward showed themselves. Dilatation with bougies was resumed after a few days, and in August No. 15 could be passed easily. The patient was shown to the members of the International Congress on Auguust 4th, and at that time, while still suffering from some pulmonary trouble, his general condition was fairly satisfactory. He passed from my care a day or two afterward, as the Throat Hospital had to be closed for the purpose of being rebuilt. He soon afterward re-entered the London Hospital, and died in that institution about the middle of October, 1881. At the autopsy both lungs showed patches of pneumonia and there was some purulent effusion in the right pleura. The gullet was found thickened to such an extent as to narrow considerably the calibre of the tube for three inches downward from the level of the cricoid cartilage. The strictured portion was found to have been divided posteriorly for about an inch at the lower part.

Dr. Roe, of Rochester, N. Y., has lately reported two cases[1] in which he has successfully used my œsophagotome. One was that of a lady, aged twenty-four, on whom he twice operated for stricture of the gullet, making on the first occasion one posterior incision, and on the second two lateral cuts, after which dilatation with bougies could be satisfactorily carried out.

The patient in the other case was a boy, aged eight years, whose œsophagus was narrowed at its lower part, through the action of a caustic fluid, to such a degree that even milk could scarcely be swallowed. Dr. Roe di-

[1] New York Med. Record, November 11, 1882, pp. 536, 538.

vided the stricture in six different places at intervals of a few days, and then practised dilatation with success.

Œsophagostomy.—The gullet may sometimes be opened either at the seat of stricture, or below it. This is an operation which, in a few cases, has proved highly successful.

History of the Operation.—The establishment of a fistulous opening in the neck for the relief of stricture of the œsophagus appears to have been first suggested by Stoffel.[1] The first recorded instance, however, in which the operation was performed, is one briefly alluded to by Tarenget[2] in 1786. The operator's name has not been preserved, but the case was more successful than any of those which have been done since. The patient was a woman suffering from what would seem to have been cancer of the gullet, and in spite of the fact that the cervical and submaxillary glands were already enlarged at the time of the operation, she is stated to have survived for a period of sixteen months, during which she was fed entirely through the fistula. More than half a century later Watson[3] published a case of what he calls tubercular stricture, in which he opened the gullet. The disease, however, was possibly malignant, as there were no signs of tubercle in the lungs. The patient—a young man, aged twenty-four—lived two months after the operation, and died of œdema of the glottis, and for which tracheotomy had to be done. The thyroid body was greatly enlarged, but does not appear to have pressed upon the gullet. Soon afterward Lavacherie[4] operated on a man, aged sixty-eight, suffering from what was probably a cancerous stricture of the œsophagus. This case is of somewhat doubtful character, as the cutting operation appears to have been undertaken mainly, if not solely, for the extraction of an ivory tube which had been passed into the stricture and could not be withdrawn. The gullet was opened, and the patient was fed through a tube, but it is not clear whether this was introduced through the wound or through the mouth. Death took place on the fifteenth day. Œsophagostomy was successfully performed by Monod[5] on a woman suffering from cancerous stricture of the upper part of the food-channel. She survived the operation three months, and died from the inevitable progress of the disease. In 1853 Follin[6] published a monograph on stricture of the gullet, wherein he advocated œsophagostomy in suitable cases. Richet[7] states that he performed the operation for impermeable narrowing of the gullet opposite the second dorsal vertebra; the canal was opened and a sound passed through the stricture and left *in situ*. Unfortunately, no further details are given, either as to the result of the case or the nature of the disease. In 1859 Bruns[8] reported the case of a man, aged thirty-eight, suffering from dysphagia, on whom he operated. The patient lived ten days, and, after death, the cause of the complaint was found to be compression of the œsophagus by an enlarged thyroid. A somewhat similar case was related by the same surgeon[9] a few years later. The patient was a man, aged thirty-seven, who had been afflicted with difficulty of swallowing for a year; œsophagostomy was done, and the man died in five weeks. In this case, as in Watson's above related, death was due to pulmonary disease and to œdema of the larynx, which made tracheotomy necessary. The thyroid was found to be somewhat enlarged, and a vast abscess with gangrenous walls was seen encircling the upper part of the gullet. Three years afterward Willett[10] performed the operation on a woman, aged forty-seven, suffering from œsophageal carcinoma; the patient had begun to regain her strength when she refused to be fed, and died of exhaustion eighteen days after the establishment of the fistula. In 1868 Cheever,[11] in an interesting report of two cases of external œsophagotomy for foreign bodies, took occasion to make some remarks on the same proceeding when practised for stricture of the gullet, and two years later the whole subject was fully discussed by Terrier[12] in an elaborate and valuable monograph. In 1870 the operation was performed by Menzel[13] on a man, aged forty-four, a patient of Billroth's,

[1] Quoted by Bonet: Sepulchretum, Lugduni, 1700, lib. iii., sect. iv., Obs. xx., p. 35.
[2] Journ. de Méd., Chir. et Phar., 1786, t. lxviii., p. 250.
[3] Dublin Journ. of the Med. Sciences, 1845, vol. xxvii., p. 260.
[4] Bull. de l'Acad. de Méd. Royale de Belgique, 1845, t. iv., p. 758.
[5] Quoted by Follin: Retrécissements de l'Œsophage, Paris, 1853, p. 116.
[6] Ibid.
[7] Traité Prat. d'Anat., Méd. Chir., 1860, 2e éd., p. 508.
[8] Deutsche Klinik, 1859.
[9] Ibid., 1865, p. 37.
[10] St. Barth. Hosp. Rep., 1863, vol. iv., p. 204.
[11] Two Cases of Œsophagotomy, Boston, 1868, p. 61.
[12] De l'Œsophagotomie Externe. These de Paris, 1870.
[13] Wien. Med. Wochenschr., 1870, No. 56, p. 1350, et seq.

who was suffering from cancerous stricture; death took place on the following day. Three years subsequently, Podrazki[1] performed œsophagostomy on a man, aged forty, who had suffered from well-marked syphilis; the patient died two days afterward, and his disease, which, during life, had been supposed to be of venereal origin, was found to be purely carcinomatous. In 1875 Poinsot[2] operated on a woman, aged fifty-five, whose œsophagus was obstructed by malignant growths; the patient expired twenty hours after the operation. In 1876[3] I recorded a case in which œsophagostomy had been performed by Evans, nine years previously, on a woman, aged forty-three. The disease was malignant, and the patient died of collapse fifty hours after the operation. In the same year a case was related by Horsey,[4] in which he operated on a boy, aged five, who had swallowed some caustic fluid; the gullet was unintentionally opened above the stricture, which was found to be quite impervious. The wound was therefore closed, and the little patient died of shock within twenty-four hours. In 1877 Kappeler[5] related two cases of œsophageal cancer in which he made an opening into the gullet through the neck. In each instance the operation had been undertaken with a view to actual removal of the disease by excision, and it was only when this was found impracticable, owing to the extent and situation of the morbid mass, that, as a desperate measure, œsophagostomy was tried. The first patient, a man, aged forty-two, died five days after the operation; while the other, a man of sixty-five, survived only forty-four hours. In the same year, Bryk[6] published a case in which he had performed œsophagostomy for the relief of cicatricial stricture; the patient was alive seven weeks after the operation, but the ultimate result is not stated. Nicoladoni[7] also recorded a case in which he had recourse to œsophagostomy. The patient was a girl, aged four, who was suffering from cicatricial stricture of two years' standing; the gullet was incised above the point of narrowing, when it was found that the tube was expanded into a pouch at its upper part. The little patient died in six days. An instance is related by Zenker,[8] where the operation was done on a boy, aged three years and a half, for cicatricial stricture. Death occurred within twenty-four hours. Simon is referred to by König[9] as having opened the œsophagus in a case of cancer, but no detail is given beyond the fact that the patient survived only thirty-four hours. Hadlich[10] operated in 1880 on a man, aged sixty, who was unable to swallow from some cause, the nature of which was not clearly made out. The patient died thirteen months after the operation, but no autopsy was permitted. In the same year Studsgaard[11] performed œsophagostomy on a woman, fifty-two years of age, suffering from cancerous stricture; she improved considerably after the operation, and died five months later from the natural progress of the disease. The same surgeon[12] operated quite recently on a girl, aged nine, who had swallowed nitric acid. Death took place eight days afterward, owing to "hemorrhage from the internal jugular vein caused by septic ulceration." In 1880 œsophagostomy was also performed by Holmer,[13] of Copenhagen, on a man, aged fifty-seven, for cancer of the right tonsil and pharynx; the patient lived two months. In 1881 Annandale[14] related three cases in which he had performed the operation for cancerous stricture. In the first the patient, a woman aged forty-two, survived three months, and finally died of septicæmia; in another the patient, also a woman, aged fifty-three, died in ten days. Unfortunately, no details are given of the third case, which is the more to be regretted as it was one of exceptional interest, a second stricture having been encountered when the gullet had been opened below the first, and gastrostomy having, therefore, been found necessary. The operation has lately been practised by Timothy Holmes.[15] The patient was a man, about fifty years of age, who suffered from malignant stricture of the œsophagus; he died about three days after the operation. Reeves[16] has also recently

[1] Wien. Med. Wochenschr., 1873, Nos. 33, 35, 36.
[2] Reported by Bidau: De l'Œsophagotomie, Bordeaux, 1881, p. 19.
[3] Med. Times and Gaz., 1876, vol. ii., p. 137.
[4] Amer. Journ. of Med. Sci., New Series, 1876, vol. lxxii., p. 114.
[5] Deutsche Zeitschr. f. Chir., 1877, vol. vii., p. 381 et seq.
[6] Wien. Med. Wochenschr., 1877, Nos. 41 and 45.
[7] Ibid., 1877, No. 25.
[8] Ziemssen's Cyclopædia, vol. viii., p. 28.
[9] Krankheiten des Pharynx und Œsophagus, Stuttgart, 1880, p. 122.
[10] Deutsche Zeitschr. f. Chir., 1882, Bd. xvii., p. 138 et seq.
[11] Hospitals Tidende. 2 R. vii., No. 43. Copenhagen, October 27, 1880.
[12] Private letter from Dr. Studsgaard to the Author, dated December 21, 1882.
[13] Hospitals Tidende, Copenhagen, 1882, No. 1.
[14] Liverpool Med.-Chir. Journ., No. 1, July, 1881, p. 14 et seq.
[15] Med. Times and Gaz., July 29, 1882, p. 117.
[16] Private letter from Mr. Reeves to the Author, dated July 20, 1882.

performed œsophagostomy on a man, aged sixty-three, who died on the eighth day. To these cases should be added one in which Butlin[1] states that he witnessed an attempt at œsophagostomy which had to be abandoned, owing to the wide extent of the disease, and another reported by Maydl,[2] in which it was found impossible to open the gullet in a case of cicatricial contraction, because of the extreme hardness of the walls.[3]

The mode of performing œsophagostomy is as follows: The patient should be placed on his back with his shoulders somewhat raised, and his head turned toward the right side. An anæsthetic having been given, the surgeon, standing behind the patient's head, should make an incision through the skin on the left side from just above the sterno-clavicular articulation to about the level of the hyoid bone. The platysma should be cut through, and if a vein of any size, such as the external or anterior jugular, is met with, it should be divided between two ligatures and turned aside. The superficial fascia should next be slit up on a grooved director along the line of the original incision, and the anterior edge of the sterno-mastoid laid bare. The patient's head should then be slightly raised so as to relax the tissues of the neck, and an assistant should draw aside the sterno-mastoid with a retractor. The omohyoid (which can be recognized by its direction inward and upward), having thus been brought into view, should be divided as near to its hyoid insertion as possible. The carotid sheath is now to be held aside, together with the sterno-mastoid, while the trachea is drawn inward by a second assistant. The connective tissue having been torn through with the handle of the knife, the left lobe of the thyroid body should be raised and pushed toward the middle line, when the trachea will be fully exposed, together with the œsophagus behind it. It may sometimes be difficult to identify the latter tube, and it may therefore be necessary to pursue the dissection down to the prevertebral muscles. At this stage a sound[4] should, if possible, be passed from the mouth through or into the stricture. By this the operator will be guided to the situation of the gullet, which should be opened by a vertical incision 2½ to 5 ctm. long, through its lateral wall. In cases of cancerous stricture the opening should be made as far below the seat of disease as possible, while in cicatricial stenosis the knife may be carried through the contracted tissues. When the tube has been opened a silk ligature should be passed through each edge of the œsophageal wound, and again through the corresponding lip of the cutaneous incision, and the gullet should be gently drawn toward the surface and loosely attached to the outer wound. A curved tube, measuring about three inches in length below and one inch above the bend, with a suitable shield at its upper extremity, should be introduced into the œsophagus through the wound, and fixed in position by means of tapes round the neck. Sutures may be used to bring the edges of the skin-wound together above and below the feeding tube, should this appear desirable.

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[1] Sarcoma and Carcinoma, London, 1882, p. 184.

[2] Wien. Med. Blätter, 1882, No. 17, p. 523.

[3] Gross (System of Surgery, Sixth edition, 1882, vol. ii., p. 495) refers to cases in which œsophagostomy has been practised by Packard and Cohen. As I am unable to find any published details of either of these cases, they have not been included in the above summary.

[4] A special instrument was devised for this purpose by Vacca Berlinghieri (Della Esofagotomia, Pisa, 1820), consisting of a curved hollow sound containing a stylet, which projects two inches beyond the distal extremity of the tube. The sound ends at its lower part in a staff grooved at one side. On pushing down the stylet, its point is protruded and thrusts the wall of the gullet outward. An ordinary flexible bougie tipped with a metal knob will, however, be found to answer just as well.

The food should, of course, be liquid, and in order to prevent it from soaking into the tissues of the neck, when the patient is to be fed, it is better to pass a second long inner tube some way down the gullet, through the shorter tube which is constantly worn. The nutritive fluid may either be injected with a syringe, or poured in through a glass funnel.

Œsophagostomy should never be performed unless there be good reason to believe that it will be possible to introduce a tube into the gullet below the seat of stricture.

On analyzing the recorded cases of œsophagostomy, it will be found that out of twenty-six cases in which the operation was performed, sixteen, *i.e.*, 61.5 per cent., died within a fortnight, while death from shock occurred within forty-eight hours in seven, or 26.9 per cent. Œsophagostomy has been performed seventeen times for the relief of cancerous stricture, four times for cicatricial contraction, three times for dysphagia caused by compression of the gullet from without, and twice for stenosis of somewhat doubtful character.[1] The longest duration of life after the operation in any of these cases was sixteen months, the shortest eighteen hours.

In the malignant cases the average duration of life after the operation was rather more than fifty-two days. If, however, Tarenget's case, in which the patient lived sixteen months, be omitted from consideration as too vaguely reported and of too ancient date to be quite trustworthy, the average term of survival in the remaining fifteen instances was twenty-four days. In seven cases of œsophagostomy for cancer, in which sufficiently full details are given for an estimate to be made, the average duration of the symptoms before the operation was six months, the longest being eleven months and the shortest three months.

In the four cases in which œsophagostomy was done for cicatricial contraction, the average duration of life after the operation was nearly seven weeks. In three of the four, however, the patients were children, and in them the average was little more than two days and a half. This high mortality of the operation in the case of children utterly negatives the opinion that the shock caused by œsophagostomy is inconsiderable.

In the three instances of dysphagia from compression the average period of survival was five months, while in the two cases of doubtful nature it was nearly two months.

Death from the immediate shock of the operation took place in four of the cases of malignant obstruction and in two of the cases of cicatricial contraction. The statistics of this operation do not show the steadily progressive improvement which is seen in the case of gastrostomy.

The great *advantages* that are claimed[2] for œsophagostomy are :

First.—That it is attended with comparatively little systemic shock.

Second.—That it facilitates subsequent dilatation of the stricture ; in other words, it is so far curative that it may enable the patient's existence to be indefinitely prolonged.

The supposed absence of shock, however, is not borne out by the actual facts, seeing that in five cases[3] death occurred within twenty-four hours

[1] Richet's case is too lacking in detail to be taken into account.

[2] While Follin (Rétrécissements de l'Œsophage, Paris, 1853, p. 125, 126), Terrier (De l'Œsophagotomie Externe, Paris, 1870, p. 62 et seq.), Annandale (Liverpool Med.-Chir. Journ., No. 1, July, 1881, p. 13), Bidau (De l'Œsophagotomie, Bordeaux, 1881, p. 38 et seq.), and T. Holmes (Med. Times and Gaz., July 29, 1882, p. 118) give a moderate support to the operation, Mr. Reeves (Trans. Clin. Soc , vol. xv., 1882, p. 29 et seq.) has come forward as an uncompromising champion of it.

[3] Menzel, Poinsot, Kappeler, Horsey, Zenker.

after the operation, while in a sixth,[1] the attempt to open the gullet had to be given up, owing to the collapsed condition of the patient. As regards the second alleged advantage, it does not appear that there is any case on record in which an œsophageal stricture has been successfully dilated through an opening in the neck.

The *disadvantages* of the operation are:

First.—That owing to the depth from the surface at which the gullet is situated, and the fact that when diseased it is often fixed to the surrounding parts, the operation is a very difficult one. (To this should be added, in cases of cicatricial stenosis, that the walls of the organ may be so tough as to make it difficult, or even impossible,[2] to cut through them.

Second.—That great *danger* inevitably attends a cutting operation carried out in immediate proximity to such important structures as the large blood-vessels and nerves of the neck, and the thyroid gland, which is not unfrequently enlarged in cases of œsophageal stenosis.

Third.—That there is great *uncertainty* in any given case whether the opening in the œsophagus can be made below the stricture. (Even when its upper limit can be made out with tolerable accuracy, the extent of the disease cannot even be guessed at, and if in an exceptionally favorable case the lower margin could be approximately ascertained, a second stricture may exist lower down.)

Fourth.—That a discharging fistula in the neck is a conspicuous disfigurement.

Gastrostomy.—This has been the most frequently practised, and will probably be proved to be the most valuable of all the operations for the relief of œsophageal stricture.

History of the Operation.—Gastrotomy, for the extraction of foreign bodies, has been practised since the sixteenth century, but gastro-stomy, or the establishment of a "mouth" in the stomach, for the purpose of feeding a patient who is unable to swallow, was first proposed and fully described by Egeberg,[3] a Norwegian surgeon, in 1837. It was, however, actually carried out for the first time in France, by Sédillot,[4] in 1849. After him it was performed by Fenger, Cooper Forster, Sydney Jones, Curling, Bryant, Van Thaden, myself, Troup, Durham, Fox, Maury, Low, MacCormac, Jouon, Smith, Clark, Mason, Jackson, Rose, Möller, Jacobi, Hjort, Küster, Tay, Heath, Verneuil, Callender, Schönborn, Lanelongue, Courvoisier, Trendelenburg, Le Dentu, Riesel, Messenger Bradley, Studsgaard, Langenbuch, and Langton. The details of all the operations performed by these surgeons may be found in an elaborate treatise published by H. Petit[5] in 1879. Since the appearance of that work cases have been reported by Littlewood,[6] Milner Moore,[7] McCarthy,[8] Escher,[9] Lücke,[10] Elias,[11] Pye-Smith,[12] Buchanan,[13] Morris,[14] McGill,[15] Gritti,[16] Krönlein,[17] Bryant,[18] Langton,[19] Golding-Bird,[20]

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[1] Maydl: Loc cit.
[2] Ibid.
[3] Memoir read before the Med. Soc. of Christiania, May 8, 1837.
[4] Gazette Médicale de Strasbourg, 1849, p. 366.
[5] Traité de la Gastro-stomie. Paris, 1879.
[6] Lancet, 1879, vol. i., p. 475.
[7] Ibid. ,1879, vol ii., p. 425.
[8] Ibid., 1879, vol. ii., p. 466.
[9] Centralblatt f. Chirurgie, Leipzig, 1880, vii., p. 625.
[10] Med. Times and Gazette, 1880, vol. ii., p. 187.
[11] Deutsche Med. Wochenschr, Berlin, 1880, vi., pp. 329–333.
[12] Trans. Intern. Med. Cong., 1881, vol. ii., p. 456 et seq.
[13] Lancet, 1881, vol. i., p. 7.
[14] Ibid., 1881, vol. ii , p. 873.
[15] Ibid., 1881, vol. ii., p. 942.
[16] Gazzetta Med. Ital. Lombardia, 1881, serie viii., t. iii., p. 3.
[17] Centralblatt f. Chirurgie, 1881, p. 16.
[18] Lancet, 1881, vol. i., p. 572.
[19] Brit. Med. Jour., July 15, 1882.
[20] Trans. Clin. Soc., 1882, vol. xv., p. 33 et seq.

Reeves,[1] Kappeler.[2] Anders,[3] Fowler,[4] Bugantz,[5] Maydl,[6] and Hume.[7] Several cases have been operated on by Howse and Davies-Colley, but the details have not been published.

The following is the best mode of operative procedure: The patient having been placed on his back, and an anæsthetic having been administered, the surgeon should first try to map out by careful percussion the situation of the stomach. The area of stomach-resonance varies somewhat in different individuals, and also in the same person according to the condition of the viscus itself. In those who have been suffering for some time from partial starvation, the organ is apt to be retracted so as to be altogether covered by the inferior margin of the thorax. To obviate any difficulty from this source the stomach has sometimes been successfully inflated with air before the operation, or ether has been pumped into the viscus from the mouth, or gas has been generated within the organ itself, by the administration, first of hydrochloric or tartaric acid, and shortly afterward of bicarbonate of soda.[8] When the stricture is not impermeable any of these plans may be of service, but none of them is necessary.

Gastrostomy should always be done with the strictest antiseptic precautions. There are three stages in the operation: 1, to open the abdominal parietes; 2, to transfix the stomach and secure it to the edges of the wound in the abdomen, and to the integument; and, 3, to open the stomach. Between the second and third stages it is most important that some days should elapse.

First Stage.—An incision should be made through the skin for a distance of two or three inches in a direction parallel to the left costal margins, and about one finger's breadth to their inner side; the centre of the incision being made to fall about three-quarters of an inch internal to the outer edge of the *rectus abdominis* muscle.[9] The lips of the skin-wound should

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[1] Trans. Clin. Soc., 1882, vol xv., p. 26.

[2] Deutsche Zeitschrift f. Chirurgie, 1882, Bd. xvii., Heft 1 and 2.

[3] St. Petersburg Med. Wochenschr., 1882, xvii., p. 185 et seq.

[4] Ann. Anat. and Surg., Brooklyn, N. Y., 1882, vi., p. 27 et seq.

[5] Quoted by Maydl: Wien. Med. Blätter, 1882, No. 22, p. 682.

[6] Wien. Med. Blätter, 1882, Nos. 15, 16, 17, 18, 19, 21, 22, 23, and 24. Twelve cases are here reported by Maydl, but the actual operator in six of them was Albert.

[7] Lancet, December 23, 1882, p. 1074.

[8] Schönborn (von Langenbeck's Archiv., vol. xxii., p. 500) fitted an india-rubber ball to the end of a fine hollow sound, which he passed down the gullet. When the ball was in the stomach it was inflated by blowing down the tube. Félizet (Lancet, October 7, 1882), in a case in which he had lately to open the stomach for the removal of a foreign body, passed a small india-rubber tube through one of the patient's nostrils into the stomach. The proximal extremity of the tube was bifurcated, a funnel being connected with one branch, and the other communicating, by means of a piece of tubing, with a recipient containing ether. The stomach was first washed out with a solution of sodium bicarbonate poured in through the funnel, and made to flow out again by depressing the tube below the level of the viscus, so as to make the former act as a syphon. When the patient was fully under chloroform the ether-holder was plunged into a vessel of water, at a temperature of 60° Centigrade, when the stomach at once became distended by the vapor. It is obvious that neither this nor Schönborn's plan could be pursued if the gullet was much narrowed. Jacobi (New York Med. Journ., 1874, vol. xx., p. 142) passed a fine catheter into the stomach, and injected a solution of bicarbonate of soda, and shortly afterward a solution of tartaric acid. Fowler (Annals of Anat. and Surgery, Brooklyn, 1882, vol. vi., p. 27) injected thirty drops of dilute hydrochloric acid, mixed with an ounce of water, followed, after an interval of from two to three minutes, by an ounce of a saturated solution of bicarbonate of soda.

[9] Some surgeons prefer to make a vertical incision along the outer margin of the left *linea semilunaris*, commencing immediately below the edge of the thorax, and continued downward for three or four inches. The incision through the rectus, as

then be held asunder, and the fibres of the rectus should be divided in a vertical direction for about an inch, all hemorrhage being at once checked by torsion of the vessels, or ligature with fine carbolized catgut. When the parietal peritoneum is reached it should be gently picked up with forceps, and a minute opening should be made in it with the knife. Through this aperture a grooved director should be introduced, on which the membrane is to be slit up in the axis of the incision through the rectus. The peritoneal sac being thus laid open, the stomach will in most cases be at once visible, but sometimes instead of it the omentum, or even the colon, comes into view. The former is not likely to mislead the operator, but as it has actually happened that the colon has been opened instead of the stomach, it is well to be on guard against such an accident. The longitudinal bands, together with the *appendices epiploicæ*, and the thinness of the walls will serve to identify the colon, which should be gently pushed downward out of the way. Should the omentum present itself in the wound, gentle traction should be made on it until the stomach is brought down so as to bulge out of the wound somewhat like a hernia.

Second Stage.—To keep the stomach in a proper position and prevent its falling back into the abdominal cavity during the remaining steps of the operation, the base of the projecting portion should be transfixed in a direction parallel to the surface of the belly by two long needles, the extremities of which should reach considerably beyond the edges of the wound on either side.[1] The stomach is thus held fast between two transverse supports resting on the surface of the body. The viscus should now be stitched to the abdominal wall, either by a single or a double series of sutures. Verneuil uses one set of stitches, the sutures, which are of silver wire, being passed first through the skin close to the edge of the wound, next through the parietal peritoneum, lastly through the peritoneal and muscular coats of the stomach, and out again ; the ends are then threaded through a perforated plate, and afterward through shot drilled for the purpose, when they are fixed by crushing the leaden ball over them with pincers. Howse, on the other hand, prefers a double circle of stitches ; the outer, which consists of carbolized silk sutures, passes through the serous and muscular tunics of the stomach, and afterward through the skin about three-quarters of an inch beyond the lip of the wound, and is here tied over pieces of quill ; the inner circle is made with ordinary sutures of fine wire or carbolized silk, and unites the serous coat of the viscus to the skin close to the edge of the incision. The object of the two circles of stitches is to provide a greater area for adhesion, the whole of the zone between the two rings being likely to unite with the abdominal parietes.

Third Stage.—As already remarked, it is most important to delay this till adhesions have been produced between the corresponding peritoneal surfaces round the wound and the stomach thereby securely fixed to the abdominal wall. Mr. Howse's method is to defer the third step of the operation till the fifth or sixth day, and by some surgeons[2] an interval of a week or even a fortnight is allowed to elapse between the preliminary

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recommended above, was first practised by Mr. Howse, to whom the greater success of gastrostomy in this country in recent years is largely due. The straight fibres of the rectus form a sphincter round the gastric wound, and the dribbling of the contents of the stomach, so prone to occur during coughing, is thereby prevented.

[1] This plan was first recommended by Verneuil (Bull. de l'Acad. de Méd., 1876, p. 1025).

[2] Maydl (loc. cit., No. 15) gives two cases where the interval was fourteen days

part and the completion of gastrostomy. The stomach may be opened by puncturing the centre of the exposed portion with a fine-pointed bistoury. As considerable hemorrhage has followed this apparently simple proceeding on more than one occasion, the surgeon should be prepared for such a contingency, the occurrence of which is probably favored by the congested condition of the islet of stomach-wall included within the ring of sutures. Pressure will probably suffice to stop the bleeding, or the risk may perhaps be altogether obviated by opening the stomach with a thermo-cautery point, after the manner of Albert. An india-rubber tube, provided with a plug, may be left in the wound, and kept *in situ* by means of a silver suture, passing through it and the skin on each side, or, as is Mr. Howse's practice, the fistulous opening, which is at first made only large enough to take a No. 6 catheter, may be gradually dilated to the size of a No. 32 instrument (French scale). In either case the wound should be dressed with a pad of lint steeped in carbolized oil (1 in 60), over which may be put an additional pad of boracic lint, the whole being kept in place by means of a body-bandage. The sutures should not be removed for about ten days.

In the interval between the second and third stages of gastrostomy the patient's strength should, if possible, be maintained by rectal alimentation. If, however, aphagia has existed for more than two or three days, it may be necessary to do the entire operation in one act.

A few words must be added regarding the manner of feeding the patient after the completion of gastrostomy, as the success of the operation greatly depends on this. Nourishment should be administered in small quantities and at very frequent intervals, and during the first few hours it should be given cold, or even iced, in order to check vomiting. The act of feeding should, as far as possible, be an imitation of the natural mode of taking food—that is to say, nourishment should be given in small spoonfuls, about half a minute being allowed to intervene between the helpings. The cause of failure after gastrostomy has undoubtedly sometimes been the unphysiological mode in which the food has been administered. At first the diet should be confined to milk, beef-tea, and a little stimulant; later on, when the stomach has become more accustomed to the novel conditions under which it has to work, light puddings of tapioca or arrowroot, hot milk sweetened with sugar, eggs boiled very soft, beef-tea, and chicken-broth may be allowed. Pounded meat or panada may be given when the power of digestion has become established. Trendelenburg[1] advises that the patient should, if possible, masticate the food, and should then blow it through an elastic tube passing from his mouth to the permanent tube in the gastric fistula. The patient has thus the enjoyment of eating, and the digestive process has the advantage of the salivary function.

Many operators have noticed that after gastrostomy the œsophageal stricture yields a little; this is probably due to relaxation of the muscular spasm, and subsidence of the inflammation which almost invariably affects the mucous membrane near the seat of disease. Hence a day or two after the establishment of the gastric fistula, a little liquid food can often be swallowed. In this way the feeding through the stomach may be minimized at first, and that organ gradually habituated to the abnormal method of receiving nutriment.

Gastrostomy has been done sixty-seven times for cancer of the gullet, twelve times for cicatricial stricture, and twice for syphilitic stenosis. On examining the records of seventy-six examples of the operation concerning

[1] Von Langenbeck's Archiv., 1878, vol. xxii., p. 227.

which I have been able to obtain sufficient details, it appears that the total number of deaths occurring within a fortnight was fifty-five, *i.e.*, 72.4 per cent.

In the cases of malignant disease the average duration of life after the stomach was opened was rather more than twenty days, the longest period of survival having been six months and the shortest twelve hours. On looking more closely into the matter, however, it is plain that the results of this operation are progressively growing more favorable. Thus, in thirty-five cases collected by Petit, and extending over a period of thirty years, the average survival of the patient after gastrostomy for œsophageal cancer was slightly more than fourteen days and a half, while in thirty-two cases in which the operation has been done for the relief of the same disease within the last three years, the average subsequent duration of life has been more than thirty days. This estimate does not include Howse's cases, which have been alluded to by several surgeons as among the most successful operations of the kind that have yet been performed. It should be added that in fifty-seven cases of which a sufficiently detailed account is given, the average duration of the symptoms at the time of the operation was about six months and a half, the longest being three years and the shortest six weeks.

In twelve cases in which gastrostomy has been done for cicatricial stricture the average of after-life has been more than five months and a half, not including a case of Bryant's, where the result is simply indicated as "cure," without further details. In these cases the average duration of symptoms at the time of the operation had been rather more than five months, the longest period having been one year and the shortest four weeks.

Lastly, in two cases in which this operation has been done for syphilitic stenosis, the average survival has been slightly over three days, while the average duration of the symptoms had been seven months and a half.

In a total number of eighty-one gastrostomies death from shock occurred within forty-eight hours in twenty, *i.e.*, in 24.6 per cent.

The *advantages* of gastrostomy are :

First.—That it can be carried out with comparative *ease.*

Second.—That there is very little *risk* in the steps of the operation itself, especially if done in two acts separated by a proper interval of time.

Third.—That there is almost entire certainty[1] of being able to effect the object aimed at, which is the establishment of an alimentary fistula altogether beyond the seat of stricture.

Fourth.—That the fistula is hidden from sight.

The only *disadvantage*, on the other hand, is that gastrostomy, with every aid of antiseptic precautions in the actual performance of it, and the improved after-treatment which is now adopted, still yields a high percentage of deaths.

Comparing gastrostomy and œsophagostomy together, it may be affirmed—first, that gastrostomy is both *easier* and *safer* to perform, the risk of hemorrhage and other surgical complications being much less ; and second, that gastrostomy *always* meets the difficulty to be overcome—that is to say, the obstruction to the passage of food into the stomach—except in those comparatively rare cases in which the stomach itself is also diseased. The effect of either procedure in relieving the patient's immedi-

[1] See, however, two cases reported by Maydl (loc. cit.), in one of which the operator was foiled by finding a large growth in the stomach itself, while in another there was a cancerous condition of the fundus and anterior wall of that organ in addition to the œsophageal disease.

ate sufferings, notably from thirst, and occasionally, in a less degree, from hunger, is often very marked, and it may be expected that the malady will make less rapid progress when the gullet is no longer exposed to irritation by persistent endeavors to swallow. It can hardly be denied, however, that the benefit of these operations has often been shown more in the euthanasia which they have brought about, than in any appreciable prolongation of the patient's life. In fact, judging from statistics alone, operative interference would seem to be attended with less satisfactory results than the milder palliative measures generally adopted. Thus, while the average duration of life in my series of 100 cases [1] of malignant stricture of the gullet in which no operation was attempted was *eight* months, the average extent of life after the first manifestation of distinct symptoms till death in fifty-three cases in which gastrostomy was performed was *seven* months.[2] The records of œsophagostomy for cancer seem at first sight more favorable than either of the above estimates, for in eight cases of which sufficient details are given to form the basis of such a calculation, the average period from the first appearance of dysphagia till death was *ten* months. This result is largely due to Podrazki's case being included. It may be pointed out, however, that the long duration of antecedent dysphagia in this case furnishes no very certain measure of the length of time during which the *cancer* had existed, the patient having suffered severely from syphilis, and the difficulty of swallowing having at first yielded to anti-venereal treatment. Moreover, as the patient survived the operation only two days, it is obvious that the weight which the case apparently throws into the scale in favor of œsophagostomy is altogether illusory. Podrazki's case may therefore be disregarded, as being merely a disturbing element in the present calculation. The remaining seven cases of œsophagostomy for malignant disease show an average duration of life of only *seven* months after the first appearance of symptoms.

On reviewing the whole subject, gastrostomy may be said to have now taken its place among the procedures of every-day surgery, and a hope may legitimately be cherished that as the increasing resources of science render earlier recognition of œsophageal disease possible, the results of the operation will be still more satisfactory in the future. The fatality of gastrostomy has been in a great measure due to the fact that it has often been performed only at the eleventh hour, when the patient was almost moribund—"a species of refined cruelty reflecting no credit on surgery," to use the words of Professor Gross.[3] Œsophagostomy has a much narrower range of usefulness; it is always more or less a "leap in the dark," and though its effect may occasionally be brilliant, it is, after all, an operation more likely to find favor with the adventurous surgeon than with the careful practitioner. In cases of syphilitic origin, however, where the stricture is at the upper part of the gullet, œsophagostomy offers a very good pros-

[1] See page 51.

[2] It is right to state, however, that the recent records of this operation, taken alone, show much better results. Thus, in twenty cases reported since 1879, the average duration of life from the first onset of the disease was seven and a half months, notwithstanding that in one case the period of survival is only reckoned as four months, and in another as ten days, though the patients in each instance were still alive, and likely to live for some time at the date of the report. If the Albert-Maydl cases alone are considered, a still more favorable result will be found. The total average in seven cases was eleven and a half months, notwithstanding that one of the patients still living at the date of report is only counted as surviving the operation six weeks.

[3] System of Surgery, 1882, sixth edition, vol. ii., p. 495.

pect of success, as the disease is much more likely to be limited in extent than either cancer or the lesion produced by corrosive fluid. As regards internal œsophagotomy, increased experience will probably show that, though its immediate results are not so frequently fatal, its ultimate effects, even when successful, are less beneficial to the patient than those of either gastrostomy or œsophagostomy.

The following is an interesting example of cicatricial stenosis of the gullet in which gastrostomy was performed :

Sarah C., aged twenty-six, swallowed hydrochloric acid on February 16, 1879. She was taken to Guy's Hospital, where the immediate symptoms were treated, but the dysphagia increased so much that on April 24th gastrostomy was performed by Mr. Howse. The patient was fed entirely through the artificial opening for nearly a year, when dilatation of the œsophagus with bougies, which had been found impracticable at an earlier period, owing to the tightness of the stricture, was again attempted. By this means the patient recovered the power of swallowing to such a degree that Mr. Howse allowed the fistulous opening to close, warning her at the same time that it would be necessary to pass a bougie occasionally. She left Guy's Hospital in August, 1880, by her own desire. On September 6th in the same year she came under my care at the Throat Hospital. A No. 2 bougie was passed, and the stricture was gradually dilated till it was large enough to admit a No. 9, and the patient's condition improved considerably. In February, 1881, however, the dysphagia had again become so severe that she had to be taken into the Throat Hospital, where for three months she was confined to bed, suffering from constant pain between the shoulders, which was increased when she tried to swallow. During all this time her temperature was always above the normal point, being often as high as 102° Fahr. in the evening. No cause, however, could be discovered for the pyrexia. After this illness the patient steadily improved for some time, notwithstanding occasional relapses. In the autumn of 1882 her gullet again became almost blocked up, in spite of constant attempts at dilatation, and she gradually lost strength till the early part of November, when she died.

The following are the notes of the post-mortem examination : The body showed little sign of wasting, there being fully an inch of fat on the abdominal walls. Both lungs were adherent to the chest walls. The œsophagus was bound to the prevertebral muscles by bands of dense fibrous tissue, rendering its separation from the surrounding parts very difficult. Barely half an inch below the cricoid cartilage the stricture commenced, and extended downward to within two centimetres and a half of the cardia. The walls of

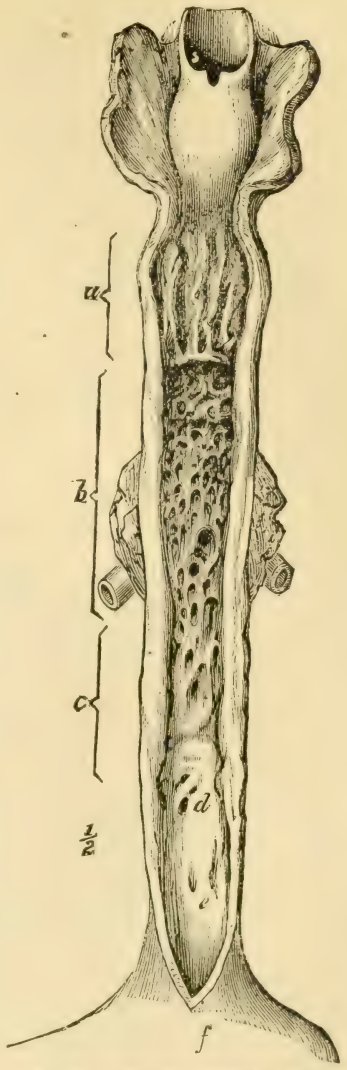

FIG. 20.—Traumatic Stricture of the Gullet, extending from within half an inch of the cricoid cartilage to within an inch of the cardia. Over the whole extent of the stricture the walls of the œsophagus can be seen to be enormously thickened. *a*, upper portion of gullet, showing vertical ridges terminating in a raised annular band; *b*, middle portion of the œsophagus, showing a network of fibrous trabeculæ with deep holes interspersed; one of these was a perforating ulcer communicating with the windpipe; outside *b* can be seen some enlarged glands and thickened tissue with the bronchi projecting at either side; *c*, smoother surface, but depressed cicatrices and raised bands still to be seen here and there; *d*, three openings communicating with the small pouch; *e*, two depressions near the cardia; *f*, the stomach.

the gullet throughout the whole of the strictured portion were enormously thickened, the cut edge in some places being an eighth of an inch in width, and very tough. The narrowest part of the stricture corresponded to the upper inch and a half of the gullet (Fig. 20, *a*), and consisted of four longitudinal ridges, mainly situated on the anterior wall, but partly on the sides of the gullet. These ridges almost blocked up the lumen of the œsophagus, which was still further narrowed below by a transverse cicatricial band connecting the longitudinal folds together. Lower down the stricture was made up of a meshwork of bands, most of which had a transverse direction. Seven centimetres above the cardia there were three openings, admitting a large probe, surrounded by some cicatricial bands. These openings communicated with a canal, which ran for two centimetres and a half downward, and slightly to the right between the muscular fibres, and terminated in a pouch covered with muscular fibres half an inch long, external to the gullet. Higher up, at a point rather below the middle of the œsophagus, there was a minute perforation, leading into the trachea through its posterior wall. The stomach was $6\frac{1}{4}$ inches in its smaller curvature, and $12\frac{1}{2}$ in its larger curvature. Its anterior surface measured $3\frac{1}{2}$ inches in its widest part and 2 inches in its narrowest part.

There was a cicatrix $2\frac{1}{2}$ inches long in the abdominal wall, and on opening the stomach a depressed cicatrix, with radiating ridges, was seen about an inch and a half from the greater curvature, and rather nearer the pylorus than the cardia. The stomach was united to the anterior wall of the abdomen by a dense fibrous tissue.

SIMPLE STENOSIS OF THE GULLET.

Latin Eq.—Strictura œsophagi.
French Eq.—Rétrécissement de l'œsophage.
German Eq.—Verengung der Speiseröhre.
Italian Eq.—Stenosi del esofago.

Definition.—Abnormal narrowness of a limited portion of the œsophagus without any morbid change in any of its component tissues at the seat of stricture.

History.—The earliest recorded example of this affection is that of Blasius.[1] More than a century later, Sir E. Home[2] related some instances in which the œsophagus presented a uniform circular contraction behind the cricoid cartilage. Cassan[3] described a case in which the gullet was contracted for a length of eight millimetres. There was not the least change in the mucous membrane at the seat of narrowing, but the pharynx above was increased to double its usual width. Cruveilhier[4] has placed on record a case of simple narrowness of the œsophageal channel at its lower part, while there was a dilated portion above, the inner surface of which was covered with large polypoid vegetations. Wilks,[5] in 1866, and Hilton Fagge,[6] in 1872, have each recorded an example of stenosis at the lower part of the tube, while Zenker[7] has lately described a case in which the œsophagus was greatly contracted at its upper part, the mucous membrane in that situation being pale, thin, and loosely attached to the submucosa, but presenting no anatomical change. At the lower part the tube was of normal calibre, but the mucous membrane was unnaturally pale.

Etiology.—The origin of this condition is exceedingly obscure. In most of the cases it is stated that the patient had a "small swallow" since childhood, but every practitioner must be aware that this phrase is used in a very vague way, and by numberless people who have no real narrow-

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[1] Obs. Anat., 1674, p. 170.
[2] Pract. Obs. on the Treatment of Strictures in the Urethra and Œsophagus, London, 1803, vol. ii., p. 414.
[3] Arch. Gén., 1826, t. x., p. 79.
[4] Anatomie Pathologique, Paris, 1835–1842, livre 38, pl. 6.
[5] Trans. Path. Soc., 1866.
[6] Guy's Hospital Reports, 1872, p. 413.
[7] Ziemssen's Cyclopædia of Pract. Med., English Transl., vol. iii, p. 19.

ing of the œsophagus. Although it is highly probable that the condition is a congenital abnormality, I am not aware that there is any instance on record in which its existence in early life has been proved by post-mortem examination. It is possible that the smallness of a portion of the gullet may be simply due to an arrest of growth in infancy or early childhood, or it may result from partial paralysis of a portion of the longitudinal fibres of the œsophagus in infant-life, the frequency of other paralytic affections at that period being an established fact. In cases where the narrowing is at the lower part, there is occasionally some degree of dilatation above, and it may be, under these circumstances, that the original formative material constituting the œsophageal walls has been unequally distributed. Dr. Wilks was strongly of opinion that the dilatation in his case, as well as the stricture, was congenital, but it is scarcely necessary to point out that a congenital stricture is extremely likely to give rise to dilatation higher up.

Symptoms.—In all the cases that have been recorded, although there has been more or less difficulty of swallowing from an early period of life, the dysphagia has remained stationary till not long before death, when, in some instances, disease has developed above the seat of stricture. In Fagge's case, during twenty years the patient had at intervals suffered from complete occlusion of the œsophagus, which on one occasion lasted for a period of eight days.

Regurgitation appears to occur chiefly in those cases in which there is a pouch above the stricture. The patients can generally swallow liquids with ease, but solids have to be washed down with drink. Evidence as to the nature of the affection can be obtained by the bougie and by auscultation, for an instrument of medium size is arrested at the seat of stricture, while on listening over the œsophagus, the food can be perceived to reach the point of constriction at the ordinary rate, while below this only a trickling or dropping sound can be heard.

Pathology.—In nearly all the cases that have been observed, it is stated that the tissues had undergone no pathological change ; but it does not appear that the muscles and nerves of the œsophagus have ever been submitted to microscopical examination in these cases. Disease is likely to be found in the part of the gullet *above* the stricture. Thus, in Cassan's case there were signs of general inflammation, while Cruveilhier's, as already remarked, presented polypoid vegetations on the mucous membrane of the dilated sac, and in Fagge's, cancer had become developed in the wall of the pouch.

Diagnosis.—The absence of any traumatic cause of stricture, the continuous existence from early childhood of dysphagia, and the non-progressive character of this symptom, serve to distinguish this class of cases.

Prognosis.—In two instances the patients lived to the age of seventy-four years, and the prognosis is not very unfavorable if great care be taken in the selection of diet. The predisposition to secondary disease above the stenosis, however, must not be forgotten.

Treatment.—It is extremely important in these cases that the patient should take only liquid or semi-liquid food of a non-irritating character, while stimulants must, as a rule, be avoided. The patient should be enjoined to eat with care and deliberation. Dilatation should not be attempted, as it could only give rise to rupture of one or more of the œsophageal tunics. There remains, therefore, only œsophagostomy or gastrostomy. Considering, however, the non-progressive character of the stricture, these operations are not likely to be called for unless some complication should arise.

COMPRESSION OF THE GULLET.

Compression of the gullet may be effected by any of the organs in its immediate neighborhood. It is seldom, however, that severe compression is produced, except in the case of constricting or cancerous bronchocele, enlargement of the deep lymphatic glands near the tube, or tumors of malignant character in the neck or in the posterior mediastinum. Neither aneurisms nor dilated heart, as a rule, gives rise to extreme dysphagia. The condition most frequently causing compression is constricting goitre. Twice I have known this to cause death by inanition; one of these will be recorded and illustrated under the head of Goitre. I have seen several examples of cancer of the thyroid gland pressing so much on the gullet as to hurry on a fatal termination. In several patients suffering from lymphoma, whom I have been called on to treat, dysphagia has been a troublesome symptom. Cases have been recorded in which compression was produced by thickening of the posterior plate of the cricoid cartilage,[1] and one instance (Specimen No. 132, Throat Hospital Museum) has come under my own notice in which this part measured one centimetre in thickness, and caused death by starvation. In other instances, dysphagia has been attributed to abnormal length of the styloid process,[2] to ossification of the stylo-hyoid ligaments,[3] and to lordosis of the spinal column.[4] Sir Astley Cooper[5] related a case in which great difficulty of swallowing was caused by the sternal end of a dislocated clavicle pressing on the gullet. The dysphagia was at once relieved on the inner end of the bone being sawn off. Morgagni[6] refers to a case in which a soldier, suffering from opisthotonos, was unable to swallow, which he attributes to the over-extension of the gullet, caused by the arching backward of the neck. It is obviously possible, however, that the œsophageal muscles may have been in a state of tetanic contraction. Some illustrations of compression caused by aneurism have been collected by Knott.[7] In general, however, as already stated, aneurisms of the aorta, even when they impinge on the gullet, do not seriously obstruct the passage of food. Out of fourteen marked cases of aortic aneurism pressing on the œsophagus, brought together by Mondière,[8] in twelve there had been no dysphagia. Perforation, however, not unfrequently takes place in such cases; and among one hundred and twenty examples of perforation of the gullet, rupture of the aorta occurred in eighteen, while the pulmonary, carotid, subclavian, inferior thyroid, and superior intercostal arteries each furnished one instance. Hypertrophy of the heart, and especially fluid effused into the pericardium,[9] sometimes occasions considerable difficulty in swallowing, but the pressure of an enlarged heart sometimes has a totally different effect, and may give rise to

[1] Travers: Med.-Chir. Trans., vol. vii.; Gibb: Diseases of the Throat, 1864, second edition, p. 378; Wernher: Chirurg. Centralblatt, 1875, No. 30; Hadlich: Deutsche Zeitschrift f. Chirurgie, 1882, Bd. xvii., p. 138 et seq.

[2] Wien. Med. Wochenschrift, No. 5, 1882.

[3] Emminghaus: Deutsches Archiv. f. klin. Med., Bd. xi., p. 304.

[4] Sommerbrodt: Berlin. klin. Wochenschr., 1875, p. 334; Heymann: Ibid., 1877, p. 763; Lennox Browne: The Throat and its Diseases, London, 1878, p. 119.

[5] Lectures on Surgery, London, 1827, vol. iii., pp. 296, 297.

[6] De sedibus et causis morb., Epist. xxviii., art. 14., Lugd. Batav., 1767, t. iii., p. 13.

[7] Pathology of the Œsophagus, Dublin, 1878, p. 217 et seq.

[8] Arch. Gén., 1833, 2e série, t. iii., p. 51.

[9] Several interesting cases of dysphagia due to this cause may be found in a short treatise by Bourceret, De la Dysphagie dans la Péricardite. Paris, 1877.

hypertrophy of the œsophageal walls. Thus Wilks and Moxon[1] have found "the muscle of the œsophagus thrice the normal thickness" from this cause.

The means of distinguishing between compression of the œsophagus and cancerous stricture have been pointed out in dealing with the latter subject (p. 63), and as regards the treatment, it is obvious that all remedial measures must be directed against the essential disease. A feeding-tube can be introduced in some cases when the normal descent is interfered with, and by this means life may occasionally be prolonged; but it must not be forgotten that when an aneurism is the cause of the compression, there is some danger in using such an instrument. Œsophagostomy, or gastrostomy, remains as a last resource, and the relative merits of the two methods should be considered not only *qua* operation (see Cicatricial Stricture of the Gullet), but more especially in relation to the nature and situation of the compression.

RUPTURE OF THE GULLET.

Latin Eq.—Diruptio gulæ.
French Eq.—Rupture de l'œsophage.
German Eq.—Ruptur der Speiseröhre.
Italian Eq.—Rottura del esofago.

Definition.—Sudden bursting of the gullet during prolonged and violent vomiting, giving rise to acute pain in the course of the tube, to extreme dyspnœa, and sometimes even to orthopnœa, to subcutaneous emphysema, and to collapse generally quickly ending in death.

History.[2]—The earliest case on record is that related by Boerhaave,[3] in 1724, as an injury of which there was no previous example in medical literature. An abstract of this interesting case will be found at the end of this article. In 1788 a case was reported by Dryden,[4] a military surgeon serving in Jamaica, in which, as in Boerhaave's patient, the gullet had given way under the strain of vomiting. In 1811 Monro[5] stated that he had in his possession the gullet of a child in whom this lesion had taken place, adding that an example of a similar occurrence had been related to him by Carmichael Smyth.[6] Both these cases, however, must be regarded with suspicion, for the reason hereafter stated in the short article on Post-mortem Solution of the Gullet, a remark which also applies to the following case, but in a less degree, owing to the symptoms observed during life. In 1812 an account was published by Guersant[7] of a

[1] Pathology, London, 1875, second edition, p. 364.

[2] Several cases of so-called rupture have been omitted in this place as being too doubtful in themselves or too incompletely described to be of much value. Such cases are those of Kade (De morbis ventric., Halæ, 1798, p. 17 et seq.); Thilow (Baldinger's Magazin f. Aerzte, 1790, vol. xii, p. 114); Bouillaud (Arch. Gén. de Méd., 1823, t. i., p. 531), and Le Ray (Roumegoux, Essai sur les Plaies et les Ruptures de l'Œsophage, Thèse de Paris, 1878, No. 369, pp. 34, 35). Two interesting but doubtful cases recently reported by Mr. Stanley Boyd (Trans. Path. Soc. 1882, vol. xxxiii., p. 123 et seq.) do not seem quite to come within the terms of the above definition.

[3] Atrocis nec descripti prius morbi historia. Lugduni Batavorum, 1724.

[4] Medical Commentaries. Edinburgh, 1788, Dec. ii., vol. iii., p. 308.

[5] Morbid Anatomy of the Gullet, Stomach, and Intestines. Edinburgh, 1811, first edition, p. 311.

[6] Dr. Carmichael Smyth was a man of considerable distinction in his profession, and physician to the King in Scotland toward the close of last century.

[7] Bull. de la Fac. de Méd. de Paris, 1812, t. i., p. 73.

rupture of the œsophagus which took place in a little girl, aged seven, during an attack of fever in which there had been much nausea and vomiting. In 1837 a case was related by Heyfelder[1] in which a drunkard died in convulsions, and after death his gullet was found ruptured at its lowest part. This, however, seems to me a very doubtful example of the accident now under consideration. In 1843 Wilkinson King[2] described as an instance of post-mortem digestion of the gullet, a case in which there appears every reason to believe that the tube had been ruptured during life. In 1848 C. J. B. Williams[3] published a case in which not only the œsophagus but the diaphragm had given way under the strain of violent and prolonged vomiting. Examples of this rare injury have also been recorded by Oppolzer,[4] Meyer,[5] Grammatzki,[6] Griffin,[7] Charles,[8] Bailey,[9] Fitz,[10] Adams,[11] and Taendler.[12] (All the unequivocal cases of rupture which have been published, among which several, though referred to in the above short historical summary, cannot be included, are placed in a table at the end of this article.)

Etiology.—The immediate cause appears always to be violent retching, in most cases following a heavy meal. In some instances the vomiting was brought on voluntarily with the help of emetics, while in others it followed a drunken debauch, or came on in the course of a severe febrile complaint. In two cases, however, the accident seems to have originated in forcible efforts to dislodge a foreign body from the gullet. In one[13] of these the action was reflex—that is to say, it consisted in vomiting ; but in the other[14] there was violent *voluntary straining* to expel the impacted substance. In both instances some bleeding took place at the time of the accident, and it is highly probable that a wound was made in the œsophageal wall. It is likely that vomiting only causes rupture when the contents of the stomach cannot be expelled through the gullet at the same rate that they leave the viscus. This want of relation between expulsion and transmission may be due to the abnormal quantity of fluid in the stomach, or to obstruction of the œsophageal canal. It is obvious also that any disease or injury causing softening or atony of the walls of the gullet, or any morbid condition of the tissues surrounding the tube which restrains its normal expansion at any part, would favor rupture.

Analyzing these causes of rupture, it may be remarked that in nearly every case of which details on the subject have been published, the stomach was sufficiently full at the time of the accident to have its contents expelled with some force. But it is probable that some temporary obstruction near the upper end of the gullet, preventing the flow of fluid matters from the stomach, is the essential factor in the rupture. To determine the cause of this obstruction is not always possible. In two cases, as already remarked, a foreign body was impacted in the œsophagus, but these were exceptions. In all the others the obstruction, if present, must have been due to something inherent in the tube itself. This is probably to be found

[1] Sanitätsbericht über das Fuerstenthum Hohenzollern-Sigmaringen während des Jahres, 1837.

[2] Guy's Hospital Reports, 1843, second series, vol. i., p. 113.

[3] Trans. Path. Soc., London, 1848, vol. i., p. 151.

[4] Wien. Med. Wochenschr., 1851, p. 65

[5] Med. Vereinszeitung v. Preussen, 1858, Nos. 39, 40, 41.

[6] Ueber die Rupturen der Speiseröhre, Königsberg, 1867.

[7] Lancet,1869, vol. ii., p. 337.

[8] Dublin Journ. Med. Sci., 1870, vol. i., p. 311.

[9] New York Med. Journ., May, 1873.

[10] Amer. Journ. Med. Sci., January, 1877, p. 17. The case is narrated by Dr. Fitz, who made the autopsy, but the patient had been under the professional care of Dr. Allen.

[11] Trans. Path. Soc., London, 1878, vol. xxix., p. 113.

[12] Deutsche Zeitschr. f. prakt. Med., 1878, No. 52.

[13] Meyer.

[14] Fitz.

in strong contraction of the circular fibres of the gullet at the upper part of the œsophagus. In two cases—those of Fitz and Wilkinson King—there was tetanic spasm, affecting in the one the flexor muscles of the limbs, and in the other the abdominal muscles; and it need scarcely be pointed out that if such a condition existed at the same time in the muscular walls of the gullet, rupture would be likely to take place. In other cases it is probable that the spasm was limited to the œsophageal muscles. Absolute obstruction, however, is not necessary; if the contents of the stomach pass into the gullet more quickly than they can escape a rupture may occur. It must be borne in mind that the upper two-thirds of the œsophageal canal are covered by striped muscular fibres, while the lower third has only unstriped fibres; and that while electrical shocks throw the former into violent contraction, the latter only take on gentle peristaltic action.[1] The lower portion of the tube would, therefore, be less capable of resisting pressure from within, and more likely to rupture. It is possible, however, that in some cases the obstruction is not caused by muscular contraction, but is due to the unyielding character of the pharyngeal orifice of the gullet, protected anteriorly by the cricoid cartilage and behind by the vertebral column.

Supposing, then, an obstruction to exist at the upper end of the tube, it becomes interesting to ascertain what strain its walls will withstand when the contents of the stomach are thrown violently into the canal. In order to determine the *bursting-point* of the gullet, I made the following experiments with the assistance of Mr. Charles L. Taylor: The upper end of a healthy œsophagus, removed from the body shortly after death, having been tied, water was thrown in at the opposite orifice by means of a forcing-pump provided with a pressure-gauge. The average pressure at which the tube gave way was rather over seven pounds, the highest being eleven and the lowest five and three-fourths. Among the subjects from whom the gullets were taken there were eight males and four females; their average age was between thirty-eight and thirty-nine years, the oldest being sixty-six and the youngest seventeen. In three of the twelve cases the rupture occurred about an inch above the ligature, *i.e.*, speaking roughly, about two inches above the cardia; in eight the rent took place at a point one or two inches higher, while in one case the gullet burst just above the junction of the lower and middle thirds. In every instance the solution of continuity was vertical in direction, and varied from a third of an inch to nearly two inches in length. These experiments imitated, as far as possible, the expulsion of the contents of the stomach through the gullet in violent vomiting, and produced a condition exactly like rupture as it occurs during life—that is to say, a vertical rent with clean-cut edges at the lower part of the gullet. Thinking it possible that the occurrence of the rent in the lower portion of the gullet might have been due to the injection having been made near that part, the experiment was reversed, and the cardia having been tied, the injection was made from above. In five out of six trials[2] the rupture occurred within three inches of the cardia, and only once higher up.

[1] Todd and Bowman: Physiological Anatomy, London, 1859, vol. ii., p. 189.

[2] In the six cases in which the injection was made from above, the average bursting-point was a trifle over six pounds, the maximum being eight and the lowest just under five. The subjects were all of the male sex, and their ages averaged nearly forty-nine years, the oldest being fifty-nine and the youngest twenty-six. The direction of the rent was vertical in every case, and its situation was from one to three inches above the point of ligature in five of the cases, while in the remaining one the

The conclusions to be drawn from these experiments are: first, that rupture by direct pressure applied within the gullet always takes place in a longitudinal direction; second, that the rent never occurs in the upper half of the tube, and in most cases is confined to the lower third; third, that the mucous membrane offers greater resistance to strain than the muscular covering. As regards the actual production of the rent, the following seemed to be the sequence of events: as the water was pumped in, the tube became distended, especially at the lower part, where the muscular coat became gradually blanched from stretching; next, in eleven of the eighteen cases, the muscle and the mucous membrane gave way together, the former presenting a somewhat irregular fissure with ragged edges, and often with nerve-fibres stretching unbroken across it, while the mucous membrane showed a clean straight slit, as if it had been cut with a knife. In the remaining seven cases the rupture took place gradually, the muscular bundles separating at one place, and leaving an interval through which the mucous membrane bulged out in a hernia-like sac, which was stretched to an extreme degree of tenuity before giving way. In all the eighteen cases the laceration of the mucous membrane was from a quarter to half an inch shorter than the fissure in the muscular coat.

There is no difficulty in showing that the walls of the tube have, in several of the published cases of œsophageal rupture, been in an abnormal condition. In one [1] of them there was slight cicatricial stricture of the gullet near the cardia; while in another [2] it is stated that the patient had had occasional difficulty in deglutition since infancy; and in a third [3] that the food could only be taken in small morsels and slowly for some years before the accident. In the two cases in which foreign bodies had been impacted, it is extremely probable that some injury was done to the wall of the gullet which lessened its power of resistance. Although in most of the other examples the mucous membrane is said to have been perfectly healthy, except as regards digestive solution, it may be pointed out that all the patients were men, and that most of them had been accustomed to the free use of ardent spirits, and had suffered from habitual vomiting—circumstances which would have been very likely to lead to slight, though perhaps not apparent, changes in the textural firmness of the lining tunic of the gullet. In one of the most recent examples [4] of this accident a small, white stellate cicatrix was found beside the lower part of the rent, and farther down there was another smaller scar, showing that ulceration had previously existed. It is highly probable, therefore, that the texture of the lining membrane of the gullet was somewhat weakened, and that the canal itself was slightly dilated. In certain instances there may likewise have been some change in the muscular coats of the œsophagus or some impairment of innervation—conditions which would, doubtless, diminish the power of resistance to strain. From the previous habits of life of those who have suffered from rupture of the œsophagus, it is likely enough that some of them were the victims of gout. As regards one patient,[5] it is expressly mentioned that this was the case.

Although it is not stated in any of the accounts that the œsophagus was bound down externally at any point, yet it is quite possible that in some cases there may have been small unobserved cicatrices in the peri-

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œsophagus gave way exactly midway between the cricoid cartilage and the diaphragm, The rupture occurred four times in the posterior wall, once in the middle line in front, and once on the left side of the tube, the length of the rent varying from three-fourths of an inch to an inch and a half.

[1] Meyer. [2] Charles. [3] Fitz. [4] Adams: Loc. cit. [5] Boerhaave.

œsophageal tissue, which would have deprived the tube of the natural mobility which no doubt helps it to bear the strain occurring during vomiting.

It remains now to consider the various other views which have been put forward as to the etiology of rupture.

Boerhaave, arguing from his unique observation, attributed the rupture to direct traction on the gullet in the act of vomiting, the lower end of the tube being drawn down by the weight of the overloaded stomach, aided by the rigid contraction of the diaphragm, while the superior extremity was forcibly stretched above by the straining efforts induced by tickling the fauces. As in Boerhaave's case there was a *transverse* rupture, it is highly probable that his explanation is correct. It does not, however, meet the other cases, in all of which the rent was *vertical*.

Zenker and Ziemssen [1] consider that the accident results chiefly from "*intra-mortem* œsophageal malacia," or softening of the coats from peptic solution in the last hours of life. With a view of testing the *traction-power* of the gullet, Ziemssen [2] suspended an œsophagus, freshly removed from the body of a powerful man, aged fifty-five, and attached weights to the lower end. It was found that, although the muscular coat gave way under a weight equal to 5 kilogr., the mucous membrane remained uninjured under a weight of 12½ kilogr. Ziemssen argues from this, that no amount of strain that could be applied within the body would cause rupture of the gullet when its tissues are in a healthy condition, or, in other words, until softening has been produced by the digestive action of the gastric juice. I have repeated this experiment in four cases with the following results: In the first the gullet (taken from a man aged sixty-four) began to stretch at a weight of 6 kilogr., and the muscular coat gave way close to the upper end on the addition of 1 kilogr. At this time the tube had lengthened fully two inches; after a weight of 8 kilogr. had been attached to it the gullet continued to stretch for a few seconds, when it ruptured close to the upper end. In the second case the œsophagus was taken from a woman aged sixty; the tube stretched a little, but without rupture, as weights were gradually added, up to 9 kilogr., when both the muscular and the mucous coats gave way with a sudden snap close to the lower extremity. The third experiment was made on an œsophagus taken from the body of a woman aged thirty: the tube began to stretch under a weight of 7 kilogr., and finally gave way at the upper end under a total weight of 11 kilogr. The fourth experiment was made with the gullet of a woman aged fifty-four, which was torn asunder suddenly close to its lower end when a weight of 6 kilogr. had been attached to it.

The average point of rupture under tension, therefore, in these four cases was 8½ kilogr., *i.e.*, about eighteen pounds, the greatest resistance being 11 and the least being 6 kilogr. The average age of the subjects was fifty-two. Hence it is probable that in Ziemssen's case the resistance was somewhat exceptional, and the varying results show, as was probable *à priori*, that there is a considerable difference in the strength of the human gullet. If, however, we accept the highest power of traction, viz., 12½ kilogr., I do not think it at all impossible that it will be found to be exceeded by the combined expulsive power of the diaphragm and the strong abdominal muscles. Moreover, it must not be forgotten that in these experiments just described the force was *gradual*, and was applied in a totally

[1] Cyclopædia of Medicine, vol. viii., p. 100.
[2] Op. cit., vol. viii., p. 96.

different way to that which occurs during life, when fluid is dashed violently and suddenly against the inner walls of the œsophagus.

The foregoing experiments, which merely show the *traction-power* of the gullet, though of value in relation to Boerhaave's case, in which the solution of continuity was horizontal in direction, have no bearing on any of the other recorded cases, in all [1] of which the rent was vertical.

Zenker and Ziemssen [2] further call attention to the occasional tearing of the pleura, which they consider "forces them" to accept the theory of œsophagomalacia. They think that the repeated efforts at vomiting cause the regurgitated food and gastric juice to remain in the gullet sufficiently long to give rise to digestive softening of its walls, and that the faint condition of the patient produces "spastic ischæmia," a condition commonly expressed by the blanched face of a person who is vomiting. This explanation appears to me somewhat far-fetched, for vomiting, with its accompaniment of so-called spastic ischæmia, is a very common occurrence, while rupture of the gullet is one of the rarest of accidents. It is further negatived by the fact that the lesion generally takes place when the stomach is loaded with food or drink, and therefore when the gastric juice is extremely diluted. The suddenness of the event, and the fact that the lesion has usually been produced when the patient was in the upright position (in which case the gastric juice could not remain in the gullet), render it highly improbable that *ante-mortem* peptic softening can be the cause of the injury. Further, were the rupture caused by digestive solution, whether before or after death, it is probable that the opening would be more or less irregular, the edges of the wound being "ragged and fringed with flocculent shreds of half-dissolved tissue" (see Post-mortem Digestion), and not a longitudinal rent with sharply cut edges, such as almost invariably occurs when the accident results from vomiting.

An attempt was made by Wilkinson King [3] to prove that no such lesion as rupture of the œsophagus during life ever occurs, the supposed symptoms of such an accident being, according to him, due to other conditions, and the rent found after death resulting from post-mortem softening. This theory was based mainly on the following case, to which I have alluded in the historical summary as an undoubted example of rupture during life:

A cabinet-maker, aged twenty-four, who had been very intemperate for years, *had complained for many months of severe epigastric pain and sickness*, and had also been troubled by loss of appetite and flatulence. While at a public supper, at about 9 o'clock in the evening, he felt sick, and soon afterward left the table. He vomited slightly, and had to be assisted home. Castor-oil was then administered. When first seen by a medical man (at 3 A.M.) the patient complained of great pain at the pit of the stomach, the abdominal muscles were rigidly contracted, he could only breathe when sitting up in bed and leaning forward on his hands, while his countenance expressed the greatest anxiety. Emetics (antimony and ipecacuanha) were given without effect. At 7.30 the pain was less severe, but the dyspnœa was much worse, and there was emphysema of the face, throat, and chest; another emetic was given, and an enema was administered, both without effect. The stomach-pump was used at 10 o'clock without result; death took place at noon—that is to say, fifteen hours after the patient had sat down to supper.

Post-mortem.—"A large rent was found in the gullet as it passes through the diaphragm, filled with ingesta from the stomach (*sic*). There was food in the posterior portion of the chest." [4] The left end of the stomach was softened by digestion. The

[1] In Wilkinson King's case the direction of the rent is not stated.

[2] Op. cit., p. 97. [3] Guy's Hospital Reports, 1842, p. 139, and 1843, p. 113.

[4] The *ipsissima verba* are given, as the passage is somewhat involved, but the author probably meant that a space, *i.e.*, the pleural cavity, communicating with the rent (not the rent itself), was filled with ingesta.

lungs on both sides seemed congested, the left being "contracted;" there was some dark offensive fluid with castor-oil floating on it in the left side of the chest. A small quantity of plastic lymph was found inside the pericardium, but the heart was healthy.

Wilkinson King himself admits the imperfection of the report of the case, observing that it was compiled from "the *hasty notes* of Mr. Comley." It is conceded that the patient died very suddenly, *i.e.*, in fourteen hours after the first marked symptom, that he vomited, and that a rent was found in his gullet after death, yet King thinks it more reasonable to attribute the death to "sudden inflammatory tumefaction of the larynx," of which there is not any evidence whatever in his published record of the autopsy. The extensive emphysema is in like manner ascribed to a "rupture of the air-tube," of which again there is no mention in the account of the post-mortem examination. No attempt is made to explain the other features in the case, such as the inability to vomit and the acute pain in the epigastrium.

My own view is that the vomiting was much more severe than it is said to have been in the "hasty notes" of the case, or that the epigastric pain, from which the patient had suffered for some months, was due to *ulceration of the œsophagus*, and that therefore its walls gave way under much less strain than in the other instances. If this latter explanation be correct, the case would closely resemble that reported by Mr. Adams.

The almost universal occurrence in these cases of subcutaneous emphysema closely following the patient's own sense of some grave accident having befallen him, is a strong argument against the theory of post-mortem digestion. It is well known that even in ordinary respiration some air is drawn into the gullet, and when dyspnœa is present (as in most cases of œsophageal rupture) the quantity of air thus *swallowed* is probably considerable. Hence, should a rent occur in the tube, it is clear that subcutaneous emphysema would be almost sure to take place. In the cases in which the bowels were distended with flatus (as in those of Boerhaave, Meyer, Wilkinson King, and Charles), it is not improbable that the gas was formed in the intestinal canal. Instead of accepting these obvious sources, Wilkinson King remarks that the pericarditis began before the dyspnœa, and says: "I impute to the latter the production of emphysema though by no means definitely. We know that violent efforts of respiration rupturing the air-tube do cause the extravasation of air into the cellular tissue as well as the fracture of the rib" (*sic*). This passage is somewhat involved, but I gather from it that King attributes the emphysema to a rent in the trachea, although, as already remarked, there is not the slightest allusion to any such lesion in the account of the post-mortem examination. It will be seen that the views of King do not deserve serious consideration, and they have only been refuted because they have so often been referred to by medical writers, who have evidently not read the original article.

It need scarcely be pointed out that the presence of the gastric contents in the mediastinum or pleural cavity does not in any way militate against the theory of rupture from violent contraction, nor support that of *post-mortem* or *intra-vitam* digestion of the œsophageal walls, for if the vomiting continue after a rent has taken place, the gastric juice and the contents of the stomach will be forced through the aperture, and may be found after death in the mediastinum, or in one or both pleural cavities.

Symptoms.—As already remarked, the accident usually occurs during vomiting after a full meal or a drunken carousal. The patient suddenly

feels as if something had given way, his face becomes blanched and expresses extreme anxiety ; cold sweat breaks out over the body, and there may even be syncope. Excruciating pain is often felt along the course of the œsophagus or in the epigastric region, or occasionally shooting through from the ensiform cartilage to the back. This last symptom, however, is not invariably present at the time of the accident ; but, as in Fitz's case, may be deferred for some hours, probably showing that the actual rupture did not take place at the first onset of the symptoms. The patient, who has previously been retching, suddenly becomes unable to empty his stomach, or can only with the greatest difficulty bring up a small quantity of the liquid that has been swallowed.[1] In three cases[2] it is mentioned that the patient could endure his suffering only when supported in a half upright position, with the body bent slightly forward. The least move-

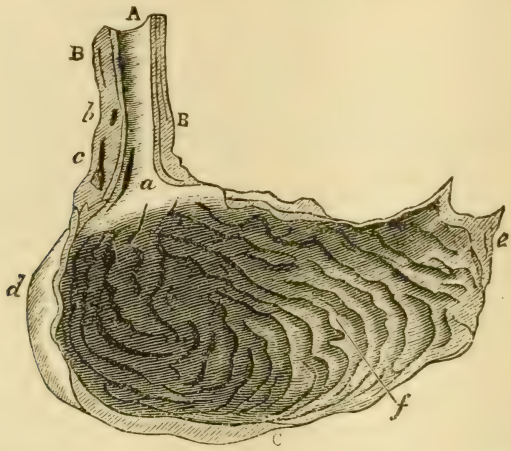

FIG. 21.—Charles' Case of Rupture of the Œsophagus (after Knott). A, the lower part of the œsophageal canal ; B, the external wall of the gullet ; C, stomach ; *a*, longitudinal fissure reaching through all the coats of the œsophagus ; *b*, small aperture communicating with left pleura ; *c*, large irregular aperture, probably accidental ; *d*, fundus of stomach, mucous membrane very soft and dark ; *e*, pylorus, near which the mucous membrane is red ; *f*, very prominent rugæ.

ment generally aggravates the pain. In nearly every instance subcutaneous emphysema has been observed, usually beginning at the root of the neck anteriorly, and extending more or less over the body. In Meyer's case, however, this was first noticed on the right side of the face. Sometimes the patient complains of thirst, and he can generally swallow with ease, although the greater part of the fluid probably passes into the mediastinum.

Pathology.—The rent in the gullet has in every recorded case been at the lower end of the tube, and in all but one[3] it has been longitudinal in direction. The exception occurred in the memorable instance related by Boerhaave,[4] an abstract of which is given farther on. In this case the two ends of the tube seem to have been drawn apart. In the other cases the rent varied from two to five centimetres in length. In most of them the gullet was torn only at one place, but in that observed by Grammatzki[5] a second longitudinal fissure was found on the opposite side of the tube,

[1] For exceptions see foot-note 5, p. 119.
[2] Boerhaave, Meyer, Grammatzki.
[3] See foot-note 1, p. 116.
[4] Loc. cit.
[5] Loc. cit.

involving, however, only the mucous membrane. Externally to the opening there is usually a cavity in the mediastinum, containing a discolored fluid, and in some instances fragments of food. Often this space, in its turn, communicates with one or both pleural cavities, which also frequently contain a large quantity of the fluid drunk during the last hours of life, but discolored with blood and softened tissue. In Boerhaave's case no less than 104 ounces of this fluid were removed from the thoracic cavity. In the examples reported by Wilkinson King[1] and Charles,[2] the greater curvature of the stomach was very much softened.

Diagnosis.—Boerhaave[3] remarks that from the description of his case any future accident of the kind could be recognized. This, however, has not proved to be the fact, for in no single instance, except that of Meyer, has the nature of the lesion been recognized during life. The diagnosis has been laid down somewhat dogmatically by Oppolzer,[4] who states that rupture of the gullet may be conjectured to have taken place when previous signs of an affection of the œsophagus having been present, there suddenly occurs violent pain along the course of that organ, with expuition of blood, great shock, and inability to vomit.[5] The "previous signs of an affection of the œsophagus" have not, however, in the recorded cases been sufficiently obvious to attract attention. Hamburger[6] suggests that auscultation may be of use, but it is extremely doubtful whether any trustworthy information can be gained by this method in such cases.

Prognosis.—All the reported cases have ended fatally, the patients generally dying within a few hours of the rupture, though in one case life was prolonged for some days. In 1 instance[7] the patient died in 4 hours, in 2[8] in 7 hours, in 2 others[9] in 12 hours; in other cases death took place in 13,[10] 14,[11] 17,[12] 18½,[13] and 24[14] hours respectively. In 1 case, however, the patient did not succumb till 50 hours[15] after the accident, and in another,[16] in which the rent was probably very small at first, and afterward extended, life was protracted for nearly eight days, during which the sufferer passed through a sharp attack of *delirium tremens.*

Treatment.—Directly the rent occurs it might be worth while to introduce the permanent œsophageal tube (vol. ii., Fig. 10, p. 16). It must be admitted, however, that the instrument would be not unlikely to pass through the rent into the mediastinum; and that should this accident be avoided, the introduction of the tube would probably give rise to attempts at vomiting. But if the instrument can be tolerated, it is within the range of possibility that a small and extremely narrow rent might heal. If, however, the patient be unable to bear the tube, it will be necessary to feed him entirely by nutrient enemata. The fact that Allen's patient lived for more than seven days shows that sometimes, at least, there is time for the employment of therapeutical measures, among which the administration of anodynes must be considered the most important.

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[1] Loc. cit. [2] Loc. cit. [3] Op. cit., p. 60.

[4] Vorlesungen über specielle Pathologie u. Therapie, Erlangen, 1872, Bd. ii., Lieferung i., p. 151.

[5] Baron de Wassenaer was slightly sick several times after the accident, and in the case of Bailey's patient, efforts at vomiting continued till death. Allen's patient also vomited the contents of his stomach frequently after surgical emphysema had occurred.

[6] Klinik der Œsophaguskrankheiten, Erlangen, 1871, p. 189.

[7] Taendler. [8] Charles and Adams. [9] Dryden and Grammatzki.

[10] Williams. [11] Wilkinson King. [12] Griffin.

[13] Boerhaave. [14] Bailey. [15] Meyer. [16] Fitz.

Table of Cases of Rupture of the Gullet.

Author.	Sex.	Age.	Drinker.	Nature of rent.	Surgical emphysema.	Duration of life after accident.	Remarks.
1. Boerhaave.	M.	50	?	Transverse in direction, tearing gullet quite asunder 2 inches above the diaphragm — opening into left pleural cavity.	Emphysema over front and sides of chest, and in the posterior mediastinum.	18½ hours.	Patient was a great eater, and suffered much from gout. He had been addicted to the free use of emetics.
2. Dryden.	M.	?	Yes.	Longitudinal rupture just above the diaphragm sufficient to admit fore and middle fingers—*probably* on the left side.	Emphysema "all round neck and throat."	From "in the morning after breakfast" till 10 P.M.	Patient avoided emetics, as he always felt weak and sore after the strain of retching. He had taken warm water just before the rupture.
3. Wilkinson King.	M.	24	Yes.	"Large rent" where the œsophagus passes through the diaphragm.	Emphysema of the face and throat.	14 hours.	There was *post-mortem* solution of the cardiac end of the stomach.
4. Williams.	M.	?	?	Longitudinal rent close above the lower end of the gullet on the left side, 1¾ inch in length, opening into left pleura.	Not stated.	13 hours.	Diaphragm also ruptured.
5. Meyer.	M.	38	Yes.	Longitudinal rent, 1¼ inch long, 3 inches above the cardia.	Emphysema of side of face, neck, and front of chest.	50 hours.	Gullet was narrowed at lower part; patient had swallowed soap-lees. Large cavity separating the gullet from the surrounding parts for 5½ inches upward from cardia.
6. Grammatzki.	M.	35	Probably.	Longitudinal rent, 5 ctm. long, running into the stomach.	Emphysema of face, neck, and chest, also of anterior and posterior mediastinum. Double pneumothorax.	From "morning" till 6.30 P.M.	Cavity large enough to hold a walnut just above cardia. Rent in cardia itself reaching to "submucosa."

7. Griffin.	M.	49	Innkeeper, but personal habits not stated.	Longitudinal rent, 1 inch in length, running upward from just above the diaphragm — opening into the left pleura.	Emphysema above both clavicles.	17 hours.	Patient had had two solid meals at a rather brief interval.
8. Charles.	M.	35	Yes	Longitudinal rent, 1½ inch long from below cardia, on left side, opening into left pleura.	Not stated.	7½ hours.	Cavity in posterior mediastinum full of grumous material. *Post-mortem* digestion of stomach.
9. Bailey.	M.	22	?	Longitudinal rent, ¾ inch long, from 1 inch above cardiac orifice.	Not stated.	24 hours.	Patient was a negro and remarkably robust.
10. Fitz.	M.	31	Yes.	Longitudinal rent, 2 inches long, in front and somewhat to the right, downward from level of bifurcation of trachea.	Emphysema almost all over the body.	180 hours (7½ days).	Cavity of size of small lemon on right side of posterior mediastinum, between gullet and windpipe, also behind gullet.
11. Adams.	M.	53	?	Longitudinal rent in posterior wall of gullet, 1½ inch long upward from diaphragm, opening into left pleura.	Not stated.	7 hours.	Old cicatrices in œsophageal wall close to rupture. The same in stomach. Patient had long been dyspeptic.
12. Heyfelder.	M.	?	Yes.	Irregular rent, of size of threepenny piece, close to cardia.	Not stated.	?	
13. Taendler.	M.	17	No.	Longitudinal rent, ½ ctm. long.	Emphysema over left half of thorax.	4 hours.	Patient was suffering from pyæmia.

ABSTRACT OF THE CASE OF RUPTURE OF THE ŒSOPHAGUS OBSERVED BY BOERHAAVE.[1]

The subject of this accident was Baron de Wassenaer, a man over fifty years of age, and of powerful frame, whose appearance betokened perfect health. In his youth he had frequently suffered from "angina," and for many years during the winter he had been subject to gout, attributed by himself to over-eating and want of exercise. After a full meal he always felt a sensation of great weight at the pit of the stomach, and to relieve this he was in the habit of taking ipecacuanha in a copious infusion of blessed-thistle,[2] though he sometimes used the latter beverage alone.

At the time of the accident which caused his death, Baron de Wassenaer was atoning by *low diet* for an excess at table committed three days before, and a glance at his last meal—an early dinner—may give some idea of the character and amount of his food when he was not stinting his appetite. It has long been supposed that the baron was a gross feeder, but after a careful perusal of the case, so eminent an authority as Professor von Ziemssen does not think this opinion warranted by the facts. An examination of the following list, which does not represent the bill of fare, but only that portion of it which was partaken of by the baron, will enable the reader to determine for himself a matter which has an important etiological bearing on the case:

Dinner.

Veal Soup, with Herbs.
Boiled Lamb and Cabbage.
Fried Sweetbread and Spinach.
Duck.
Two Larks.
Compote of Apples.

Dessert.

Pears, Grapes, Sweetmeats.

Beer and Moselle.

In justice to Baron de Wassnaer it must be stated that he does not seem to have eaten largely of any of these viands, except perhaps of the duck, of which he took a leg and breast. In the afternoon he went out riding, and returned in his usual health. No supper was taken, but about half-past ten in the evening, he began to complain of the old disagreeable feeling about the stomach, and he swallowed three tumblerfuls of a hot infusion of thistle. As this did not act with its usual efficacy, he took four more glasses of the same infusion, but still without effect. Much surprised at this, the baron ordered another dose to be prepared, and in the meantime strove to excite vomiting by tickling his fauces. While straining violently he suddenly felt a horrible pain, and gave such a cry of anguish that his servants hastened to his assistance. He exclaimed that something had burst or been violently displaced near the pit of the stomach, and that he was sure he must die immediately. He was put to bed in a state of utter prostration, being pale, bathed in cold sweat, and pulseless. Half an hour after the seizure he swallowed four ounces of olive oil, and with the help of his finger succeeded in vomiting some of the oil together with a certain quantity of the thistle-infusion. Two ounces more of olive oil, however, produced neither nausea nor vomiting, and the pain increased. Shortly afterward the baron drank about six ounces of warm spruce beer.

On his arrival Boerhaave found the baron sitting in bed, with his body bent forward almost double. Three servants supported him in this attitude, as every other posture, especially sitting or standing upright, caused excruciating agony. On examining his patient, Boerhaave found that there was nothing to be seen in the throat; there was no nausea, scarcely any eructation, the breath was not offensive, there was neither pain nor difficulty in swallowing, there was no thirst, and the feeling of weight about the stomach was no longer present.

No swelling or hardness could be detected in the chest or abdomen. The urine was

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[1] The original occupies seventy closely printed pages.

[2] *Carduus* or *Cnicus Benedictus*. This herb was once much used as a febrifuge and tonic and as a mild diaphoretic. The infusion is said to induce vomiting, or rather to assist the action of emetics, but probably it has much the same effect as warm water.

natural, and could be passed without difficulty. The patient's body seemed to be of normal temperature, the pulse quick and full, but regular, the breathing and sound of the voice natural. There was frequent deep sighing, but no cough. The color of the baron's face was natural, his mind was quite clear, and there was no paralysis. In short, the only sign of disease was the agonizing pain felt by the patient, and an indefinable sense of some change in the situation of parts within the chest. The pain was situated at first in the epigastric region, and was described by the patient himself as a feeling of some sensitive membrane having been torn; it never ceased, and hardly abated for an instant Later on, the pain, without leaving its original seat, extended backward, then along the sides, and finally over the whole inner wall of the chest. The patient stated that flatulence caused extreme suffering, the gas apparently not finding its way up; he could feel it leave the stomach, and then almost immediately experienced an excruciating pain in the chest. The physician in vain sought for a satisfactory explanation of the phenomena, the possibilities of "internal inflammation," thoracic tumor, displacement of parts, poison, and gout being successively considered and dismissed.

Boerhaave was inclined to give a hopeful prognosis from the absence of any symptom of disease except pain, which, in spite of its atrocious severity, he did not think would be sufficient to cause death. With the view of diminishing his agony, the patient was bled almost to syncope, but this measure failed to give the slightest relief. Poultices applied near the stomach made his sufferings worse. Anodyne draughts were administered, but the use of narcotics was avoided, as tending to lessen excretion. The bowels were emptied by enemata. The voiding of urine was diminished to a few drops, passed with great straining and a sensation of scalding. The urine was thick, red, and strong-smelling, these characters proving to Boerhaave's mind that none of the abundant quantity of fluid which the baron had swallowed could have reached the kidneys. The heart now (sixteen and a half hours after the seizure) began to fail, the face grew pale, the extremities cold, the breathing became hurried, and though the patient's mind continued clear, death seemed imminent from mere exhaustion. As a last resource, thinking that possibly the cardiac orifice of the stomach was obstructed by undigested food, Boerhaave ordered two ounces of sweet almond oil, to be followed by seven ounces of warm water, and directed that the action of the remedy should be assisted by tickling the fauces with a feather dipped in oil. As the result of this, a little dark liquid was thrown up, but none of the oil returned, and no relief was obtained. Here it may be mentioned that there had been no hiccough during the whole course of the affection. Boerhaave was still inclined to believe that the upper orifice of the stomach was blocked up; on reckoning up the large quantity of drink taken by the patient, and the small amount vomited up or passed as urine, it seemed clear that the fluid could not have reached the stomach. A swelling was now observed in the epigastrium, which seemed to confirm this view. Shortly after the administration of the last emetic, eighteen and a half hours from the beginning of his cruel suffering, the baron showed signs of collapse, and, rather to the surprise of his physician, suddenly expired.

Autopsy, twenty-four hours after death.—A large livid stain was seen on each side of the thorax, with black patches here and there. There was emphysema all over the front and sides of the chest. The abdomen was inflated and extremely tense. On opening it, the peritoneum, intestines, and stomach were all found enormously distended with air, but to Boerhaave's extreme amazement, the latter viscus contained only a few drops of reddish-brown fluid. The bladder was empty and contracted On opening the chest cavity Boerhaave, who at the time knew nothing of the nature of the patient's last meal, remarked a strong smell of roast duck. The pleural sacs were found distended with gas, the lungs collapsed and almost bloodless. In each side of the chest there was a large quantity of fluid resembling that previously seen in the stomach, mixed with some of the thistle-infusion. Floating on this was the almond oil ordered by Boerhaave, but, on careful examination, not a drop of blood or pus could be seen. The fluid collected from both sides of the chest measured 104 ounces (Amsterdam measure). On the part of the pleura covering the left side of the œsophagus, at a distance of two inches from the diaphragm, there was a discolored patch about three inches in diameter, in the middle of which a fissure was perceived half an inch in length, and three lines in breadth. This fissure was found to communicate with a space in the mediastinum, from which the retracted ends of the ruptured œsophagus had been drawn asunder in opposite directions. The most minute inspection failed to show the least sign of ulcer or other disease in the œsophagus; Boerhaave emphatically states that though he searched in the expectation of finding some pre-existing lesion of the gullet-walls to explain so unprecedented an accident, the more he looked at the edges of the rent and the surface of the œsophagus near them, the more perfectly healthy they seemed to be. The stomach was also quite free from disease.

ABSTRACT OF DR. FITZ'S CASE OF RUPTURE OF THE GULLET.

The patient was a man aged thirty-one, whose constitution was much impaired by the abuse of alcohol. For several years he had cut his food into small pieces and eaten it very slowly, but he had experienced neither pain nor difficulty in swallowing. About a year previous to the accident he had suffered from *delirium tremens*, followed by very obstinate gastritis, from which, however, he recovered, but a few weeks before his death he had another attack of inflammation of the stomach. On both occasions the vomiting was distressing, and was accompanied by hæmatemesis.

At supper one evening he was suddenly "partially strangled" by a piece of food which lodged in his throat. There was intense discomfort, but no cyanosis or dyspnœa. About an hour after the occurrence, by straining with his whole strength, he succeeded in dislodging the impacted substance, which was shot out with considerable noise, as if discharged from a popgun. It proved to be a piece of gristly meat one inch in length, and rather more than half an inch in diameter. The patient then fell back exhausted, and spat up some liquid and clotted blood. A swelling (emphysema) was soon afterward observed at the angle of the jaw on the left side, and a little later a similar swelling appeared on the right side, the two soon extending and meeting across the front of the neck. The patient was thirsty, and could swallow fluids easily. He did not complain of pain, but his face had an expression of great anxiety. There was some tenderness on the left of the trachea just over the clavicle. There was slight nausea, and the patient had vomited about an hour after the accident, there being no blood in the matters brought up. He was drowsy, but could not sleep. During the night pain came on in the left side of the chest, and also in a less degree on the right side, and at the upper part of the back; the swelling of the neck extended down the arms to the fingers and over the front of the chest, the skin being tense, hard, and dark, and having the appearance of erysipelatous inflammation. There was tenderness on both sides of the trachea, and ropy mucus mingled with blood was constantly expectorated. *The contents of the stomach were frequently vomited*, sometimes mixed with blood.

The treatment consisted of hypodermic injections of morphia together with bismuth internally, and a mustard poultice over the stomach. Ice was given to assuage the burning thirst, cooling lotions were applied to the swollen skin, and the patient was fed with milk and beef-tea. During the next two days there was little change in his condition; the emphysema had spread over nearly all the subcutaneous tissue of the body. The bowels and kidneys acted regularly. The patient was very weak and restless, but Hoffmann's anodyne seemed to give him relief. During the fourth, fifth, and sixth days he passed through an ordinary attack of *delirium tremens*, falling into a deep stertorous sleep on the evening of the sixth day. He could retain the food and stimulants given to him. On the seventh day he passed three bloody stools, and had three fits of "cramp," each lasting for half an hour. They began with trembling of the limbs, which was followed by rigid and painful contraction of the flexor muscles. There was excruciating pain over the heart and stomach, together with apparent dyspnœa; the countenance expressed great terror, but there was no loss of consciousness. After each fit there was profuse cold sweating. On the eighth day, after a quiet sleep, the patient woke up quite rational. He took some nourishment and a little stimulant, but became more and more prostrate, and died quietly just seven and a half days after the beginning of his illness.

Autopsy by Dr. Fitz, forty-eight hours after death.—The anterior mediastinum was emphysematous. The right lung was partly adherent to the chest-wall by recent fibrinous exudation. There was a cheesy nodule in the apex of the right lung, and a similar deposit in the upper lobe of the left lung.

In front and to the right, from the level of the bifurcation of the trachea downward, the œsophagus presented a longitudinal rent two inches in length, reaching completely through all its coats. The edges were clean-cut, and there was no evidence, even on microscopic examination, of pre-existing ulceration or degeneration. The wound opened into a cavity in the right side of the posterior mediastinum, extending between the gullet and the trachea in all directions, and also partly behind the former. This space might have contained a small lemon, and was crossed by fibrous trabeculæ, the intervals between them being filled with clotted blood. The walls of the cavity were of greenish hue, and the vagus nerve could be seen behind, thickened and red. The internal surface of the gullet, from the tracheal bifurcation down to the cardiac orifice of the stomach, was greenish in color, the epithelial layer was flocculent, and here and there somewhat thickened, but it was entirely wanting over a space about an inch in diameter below the rent. The œsophageal walls were of normal consistence.

The stomach showed the usual appearance of chronic catarrhal gastritis; there was no trace of *post-mortem* softening. Some black grumous material, probably altered blood, was found in the intestines, the spleen was enlarged and softened; there was "cloudy swelling" of both kidneys, and fatty infiltration of the liver. The heart presented signs of fatty degeneration.

WOUNDS OF THE GULLET.[1]

Latin Eq.—Vulnera œsophagi.
French Eq.—Plaies de l'œsophage.
German Eq.—Wunden der Speiseröhre.
Italian Eq.—Ferite del esofago.

Definition.—Wounds of the œsophagus of an incised, punctured, or contused character, caused by sharp bodies penetrating the walls of the tube either from within or from without, always giving rise to dysphagia.

History.—Wounds of the œsophagus have hitherto attracted comparatively little notice, owing to the fact that this organ is seldom injured alone. Its deep situation, indeed, protects it to a very great extent from external wounds. When the gullet is wounded the windpipe and the large vessels of the neck are generally implicated in the injury, and from the urgency of the immediate symptoms they absorb the attention of the surgeon.

Ambroise Paré[2] appears to have been familiar with wounds of the gullet, and he directs that they should be treated with sutures when possible to apply them. He placed on record[3] an extraordinary case in which the windpipe and gullet were both completely divided. Paré succeeded in uniting the divided trachea sufficiently to allow of the patient recovering the power of speech so far as to be able to name his assailant, but all his efforts to bring the retracted ends of the œsophagus together in the same way failed, and death took place on the fourth day.

Isolated cases were reported by Larrey,[4] Boyer,[5] and Dupuytren,[6] but the subject was first systematically treated by Horteloup.[7] More recently several additional cases have been brought together by Durham[8] and Knott.[9]

Etiology.—Wounds produced by the perforation of small sharp substances that have been swallowed will be referred to under Foreign Bodies, and it therefore only remains to consider wounds arising from the introduction of cutting weapons, such as swords and foils, and those caused by external injury. Accidents belonging to the former category are extremely rare, but a case is recorded by Levillain,[10] in which an officer while fencing received a wound from a foil as he was stooping. The point of the foil entered his mouth, lacerating the soft palate, and ran through the posterior wall of the œsophagus at the level of the fourth or fifth dorsal vertebra. A remarkable accident was related by Dr. Parkes[11] in which a sword-swallower pushed his weapon through the anterior wall of his gullet five

[1] Extensive wounds in which the gullet is only one of several important structures involved will be considered in a separate article under the head of Cut-throat.

[2] See the chapter, Des Plaies de l'Œsophague, Œuvres (Malgaigne's edition, Paris, 1840), vol. ii., p. 90.

[3] Œuvres, liv. x., ch. 31.

[4] Clinique Chirurgicale, Paris, 1829, t. ii, p. 158.

[5] Traité des Maladies Chirurgicales, t. vii., p. 279.

[6] Blessures par Armes de Guerre, t. ii., p. 334.

[7] Plaies du Larynx, de la Trachée, etc. Paris, 1869.

[8] Holmes' System of Surgery, London, 1870, second edition, vol. ii., pp. 445 and 457.

[9] Pathology of the Œsophagus, Dublin, 1878, pp. 151–154.

[10] Journ. Univ. de Méd., 1820, p. 238.

[11] Trans. Path. Soc., London, 1848–49, p. 40.

and a half inches below the pharynx. The pericardium was pierced, most acute inflammation of the membrane ensued within an hour, and the patient died on the second day. No other injury was found after death. A peculiar feature in this case is that while one of the immediate symptoms caused by the wound was violent vomiting, the matters thrown up consisted solely of the contents of the stomach without a drop of blood. An extraordinary case was reported by Guise,[1] of Charenton, in which a lunatic thrust the handle of a fire-shovel into his throat with such force that it tore through the gullet, and fractured the fourth rib at the costo-vertebral ligament.

In illustration of injury from without there are several examples. Boyer[2] has described the case of a young man, who received a bayonet-thrust at the anterior and upper part of the chest, causing a wound four lines from the sternum between the third and fourth ribs, from which there was a violent escape of air. Three days later food and drink appeared through the wound, but the patient ultimately recovered. Larrey[3] has reported an example of this accident which proved fatal. The patient, who had recived a sword-thrust at the upper part of the chest, between the first and second ribs, at first improved under treatment, but was ultimately suffocated in trying to swallow some large pieces of bread. In another instance,[4] the patient, having received a wound between the fifth and sixth ribs, died at the end of thirty-six hours, all fluids that were drunk passing through the wound. There is also a case on record[5] in which a soldier was wounded by a bullet which traversed the œsophagus at its upper part. Drink passed through the wound, but the patient ultimately made a good recovery. In Dupuytren's[6] case, the patient, a woman, was stabbed just above the clavicle on the left side. She died on the seventh day, the fact that the gullet was wounded not having been recognized during life.

Symptoms.—The characteristic symptom of wounds in the œsophagus is the escape of food from the opening. It must not be forgotten, however, that when the trachea or larynx is injured from without, and especially if the pneumogastric or superior laryngeal nerve has been divided, the food may pass into the windpipe, and, as in wounds of the gullet, may come out through an opening in the neck. In most of the reported cases, violent hiccough and intense thirst have been present. There is often difficulty in breathing, but this appears to be due to complications arising from injury of the lungs or trachea.

Diagnosis.—The history of the case, taken in connection with the objective signs, generally renders the diagnosis easy. It is only in rare instances, such as that of Dupuytren, where a wound was inflicted on the œsophagus through the neck, and fluids subsequently swallowed did *not* escape, that the nature of the accident is likely to be overlooked. Possibly some cases of this kind occur which are never suspected, for, as Horteloup[7] points out, stabs with a knife or dagger as a rule cause only minute punctured wounds.

Prognosis.—For many years it was supposed that complete transverse division of this tube always proved fatal, and this was strongly supported by the experiments of Jobert.[8] This view, however, has been proved to

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[1] Quoted by Horteloup: Op. cit., p. 24.
[2] Traité des Maladies Chirurgicales, t. vii., p. 279.
[3] Clinique Chirurgicale, Paris, 1829, t. ii., p. 158.
[4] M. C. Etienne: Consid. génér. sur les causes qui gênent ou empêchent la déglutition, Thèse de Paris, 1806, p. 8.
[5] Horteloup: Op. cit., p. 61.
[6] Loc. cit.
[7] Op. cit., p. 19.
[8] Boulin: Plaies de l'Œsophage, Thèse de Paris, 1828, p. 20.

be fallacious. When the wound is in the cervical portion of the gullet, and is limited to that organ, the case almost invariably does well; but of course, if the air-passages are injured at the same time, the prognosis is much more serious. Wounds in the thoracic portion are extremely fatal.

Treatment.—If the wound be large the edges should, if possible, be stitched together. The patient should be entirely fed by nutrient enemata (vol. i., p. 425). If, however, this mode of administering nutriment does not seem sufficient to sustain the patient, he should be fed by the œsophageal feeding-tube (vol. ii., Fig. 11, p. 17) passed an inch or two beyond the wound; and if there be any difficulty in carrying out this treatment, an anæsthetic should be administered each time that the patient is fed. In some cases, however, owing to the irritation caused by the passage of the instrument, or to the impossibility of striking the orifice of the lower segment of the œsophagus when it has been completely cut across, it may be necessary to allow the patient to swallow bland liquids. Although, under these circumstances, most of the food will escape by the wound, a small quantity will trickle down the gullet. "When the necessities of nature require nourishment to be taken by the mouth," as Heister[1] remarks, "the wound should constantly be diligently cleaned afterward, lest any part of what was taken should stick by the way and putrefy, which would bring on very bad symptoms." It is only when there does not appear to be the slightest chance of the wound healing, that the patient should be nourished by means of an instrument passed through the neck.

As a rule, a very nutritious and stimulating diet is necessary, and, in most cases, anodynes are required.

FOREIGN BODIES IN THE GULLET.

Latin Eq.—Corpora adventitia in œsophago.
French Eq.—Corps étrangers dans l'œsophage.
German Eq.—Fremde Körper in der Speiseröhre.
Italian Eq.—Corpi stranieri nel esofago.

Definition.—Foreign bodies lodged in the gullet, most commonly gaining access to that canal by the mouth, but occasionally passing up from the stomach, and more rarely still entering through the neck, giving rise to dysphagia, sometimes to dyspnœa, and often causing death.

History.—The literature relating to the impaction of foreign bodies may be said to begin with the elaborate memoir on the subject presented by Hévin[2] in the middle of last century to the French Academy of Surgery. In this essay the author collected nearly all the instances of this accident scattered throughout the medical records of former times, and discussed the best methods of dealing with such cases. His work remains to this day the most complete account of foreign substances lodged in the œsophagus, and subsequent writers have added little to it, except descriptions of more convenient instruments for exploration of the canal and the extraction of bodies impacted in it. Bordenave[3] soon afterward published a short memoir on "Foreign Bodies in the Gullet," and a work by Eckhold[4] on the same subject appeared in 1799, in which the instrument now known as Gräfe's coin-catcher is described and figured.

[1] General System of Surgery, English Transl., 1743, vol. i., p. 77.
[2] Mémoires de l'Académie R. de Chir., 1761, vol. i, p. 444 et seq.
[3] Thesis de corporibus extraneis intra œsophagum latentibus. Parisiis, 1763.
[4] Ueber das ausziehen fremder Körper aus dem Speisekanal. Leipzig, 1799.

This author, however, does not claim to have invented it, but says that he had first seen it used in London. In 1830 Mondière [1] devoted one of his papers on the œsophagus to foreign bodies in that canal. Several years later essays were written by Simon,[2] Haken,[3] Bournéria,[4] Pawlikowski,[5] and Gebser,[6] and in 1867 Adelmann [7] published a collection of 314 cases of foreign bodies in the gullet and pharynx.[8] In 1868 a thesis on "Foreign Bodies in the Gullet" was written by Martin,[9] and in 1876 von Langenbeck [10] published the mature results of a very large experience of such accidents. In 1879 Nevot [11] brought together several interesting cases in which foreign bodies had perforated the gullet and laid open neighboring blood-vessels.

Etiology.—The most common cause of accidents of this kind is the lodgment in the gullet of substances such as fragments of bone, gristle, fruit-stones, or even pieces of wood swallowed with the food, or the impaction of large unmasticated morsels in hurried or gluttonous eating.[12] Such foreign bodies as pins and needles,[13] knives,[14] forks,[15] spoons,[16] buckles,[17] rings,[18] keys,[19] coins, singly or in *rouleaux*,[20] seals,[21] beads,[22] nails,[23] and stones [24] have found their way into the œsophagus by accident, or have been deliberately swallowed by insane people, or out of mere bravado by persons considered sane. Sometimes jewels or money have also been swallowed for the purpose of concealment. An extraordinary instance is on record [25] of a blacksmith who was killed by a fragment of a red-hot key which he was in the act of forging. The key broke, and a bit of the metal

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[1] Arch. Gén., 1830, 1re série, t. xxiv., p. 388 et seq.

[2] Des Corps Étrangers dans l'Œsophage. Strasbourg, 1858.

[3] De corporibus alienis œsophago illatis. Dorpati Livonorum, 1859.

[4] Des Accidents produits par les Corps Etrangers arrêtés dans l'Œsophage. Strasbourg, 1860.

[5] De corporibus alienis in œsophago. Vratislaviæ, 1860.

[6] Ueber fremde Körper im Œsophagus und Pharynx. Leipzig, 1865.

[7] Prager Vierteljahrschrift f. prakt. Heilkunde, vol. xcvi., p. 66 et seq.

[8] This unfortunate mingling of cases diminishes the value of the paper. General conclusions drawn from such statistics are fallacious, inasmuch as the impaction of foreign bodies in the pharynx is *ceteris paribus* far less dangerous than when they are lodged in the gullet.

[9] Des Corps Étrangers de l'Œsophage. Thèse de Paris, 1868, No. 117.

[10] Berlin. klin. Wochenschr., December 17 and 24, 1876.

[11] Perforation des Gros Vaisseaux par les Corps Étrangers de l'Œsophage. Thèse de Paris, 1879, No. 81.

[12] See Paré, Le Dran, Fabricius Hildanus, Wierus, Rhodius, Houillier, all in Hévin, loc. cit., pp. 446, 447, 448, and 455.

[13] See particularly Lond. Med. Gazette, February, 1844, where a case is related by Bell in which death resulted from perforation of the right common carotid, and Schmidt's Jahrbuch, vol. xxxix., p. 334, where an instance is recorded in which death occurred from gastritis more than two years after the foreign bodies had been swallowed.

[14] Hévin: Loc. cit., pp. 471, 515, and 595.

[15] Ibid., p. 518. Hénocque: Gazette Hebdom., 1874, p. 229.

[16] Fournier: Dict. des Sciences Méd.—Art. Cas rares. Baraffio: Progrès Médical, 1876, p. 70.

[17] Harrison: Dublin Journal of Med. Sci., vol. viii. Fournier: Loc. cit.

[18] Hévin: Loc. cit., p. 449.

[19] Edinburgh Med. and Surg. Journ., 1843, vol. lx., p. 195. The French poet Gilbert died in the Hôtel-Dieu in 1780, having swallowed the key of his room five weeks before, while delirious from the effect of an injury to his head.

[20] Hévin: Loc. cit., pp. 449, 452, 455, 459. Gay: Boston Med. and Surg. Journ., 1879, p. 356. Mignot: Gazette Hebd., October 30, 1874.

[21] Billroth: Archiv f. klin. Chir., 1872, vol. xiii.

[22] Monti: Jahrb. f. Kinderheilk., 1875, vol. ix.

[23] Harrison: Dublin Journ. of Med. Sci., vol. viii. Hévin: Loc. cit., p. 471.

[24] Castresana: España Medica, August 18, 1859. Holmer: Med. Times and Gaz., January 13, 1883, p. 47.

[25] Bierfreund: Med. Zeitung Russl., 46, 1848.

flew down the man's throat and lodged in his gullet. False teeth and palate-obturators have sometimes slipped down into the gullet, and this mischance is especially likely to happen during sleep or unconsciousness, if such objects are not removed from the mouth. A curious case has been reported by von Langenbeck,[1] in which a woman who had suffered from syphilis was for some time in a critical condition from the greater part of the bony framework of her nose having become detached by necrosis, and fallen into her gullet while she was asleep. Many accidents have occurred from the well-known propensity of infants to put into their mouths anything which they can lay their hands on. Older children have sometimes swallowed playthings which they have had in their mouths on going to sleep. There are also cases on record in which children have introduced most dangerous foreign bodies into other people's throats. In two instances of this nature, fish-hooks have been fixed in the œsophagus, apparently through a precocious love of sport. In one case,[2] a little boy, finding his mother asleep with her mouth open, ingeniously introduced a fish-hook attached to a line. The mother suddenly awaking, involuntarily swallowed the hook, which, after passing several inches down, penetrated the walls of the gullet. In another case,[3] a boatman's children, aged five and four years respectively, agreed to "play at fishing," the elder persuading the younger to take the part of "fish." The hook was baited with a tempting morsel, and the younger boy, having played round it for some time after the manner of fishes, seized it with his mouth and swallowed it. The youthful angler at once dexterously jerked the line, and hooked the "fish" near the lower end of the gullet. In both these remarkable cases, the hooks were removed by an ingenious device to be presently described.

There are several instances in which ears of rye are stated[4] to have been taken into the œsophagus with serious and even fatal results, but a careful study of these cases shows that in nearly all of them the foreign body had really been drawn into the trachea, and not into the gullet.

Frogs,[5] small live fish,[6] eels,[7] and even snakes[8] have in various manners found their way into the œsophagus, and there are a considerable number of cases in which severe symptoms have been caused by the presence of a leech[9] in the gullet. All the recorded examples of the latter accident have occurred in soldiers, which is accounted for by the fact that during campaigns, brackish water has often to be hurriedly drunk out of wayside pools.

Undigested substances thrown up from the stomach have not unfrequently become impacted in the gullet.[10] Parasitic worms have been vomited through the mouth after having caused obstruction of the œsophagus.[11]

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[1] Memorabilien Jahrg., Bd. xxii., Heft 1.

[2] Leroy: Revue Méd.-Chir. de Paris, 1847, t. ii., p. 110.

[3] Baud: Ibid., 1848, t. iii., p. 44.

[4] Hévin: Loc. cit., p. 553. Desgranges: Journ. de Médecine, t. xxxviii., No. 1359.

[5] Allgem. Repert., 1838, ix., p. 109.

[6] Union Médicale, 1863, p. 568. Archiv f. klin. Chir., 8, p. 481. Norman Chevers: Manual of Med. Jurispr., Calcutta, 1870, p. 619.

[7] Allgem. Repert., 1838, xi., p. 90.

[8] Ibid., 1838, xi., p 89.

[9] Journ. Univ. des Sciences Médicales, January, 1828. Baizeau: Gazette Médicale de Paris, 1863.

[10] Hévin: Loc. cit., p. 455. Boulard: Archives Gén., t. xxiii., p. 528.

[11] Laprade: Compte rendu des Travaux de la Société de Médecine de Lyon, 1821, p. 62. Méplain: Journ. Complém., t. xvii., p. 372.

One of the most complicated cases of foreign body in the gullet is related by Adelmann,[1] in which a man swallowed a piece of mutton with some of the bone. Attempts at extraction with forceps, and at propulsion with the sponge-probang, having failed, Gräfe's coin-catcher was tried. This instrument was passed below the foreign body, but became so tightly wedged in that it could not be withdrawn. The unfortunate patient remained with this additional foreign body in his gullet for more than two days. The coin-catcher was finally loosened by means of a gum-elastic catheter, which was threaded over it, and when the impacted instrument had been got out, the original foreign body was pushed into the stomach. The patient succumbed about a fortnight after the first accident, but it does not seem that the fatal result was in any way caused or accelerated by the surgical mishap. A similar accident occurred quite recently to Dr. Holmer, of Copenhagen, while attempting to pull out a stone impacted in the gullet of a lunatic who had swallowed it with suicidal purpose. External œsophagotomy was at once performed, and both the foreign bodies were removed, the patient making a good recovery. The stone was 5 ctm. long, and 5 ctm. broad at its widest part.[2]

Symptoms.—Foreign bodies which are at all large are especially liable to be arrested at the upper orifice of the œsophagus, or at the middle third where the left bronchus crosses the gullet. Small sharp bodies, such as pins and fish-bones, may stick into the œsophageal wall at any level. The symptoms depend mainly on the consistence, dimensions, and form of the foreign body. Thus, bodies of soft structure, such as pieces of food, even when large, though temporarily obstructing the œsophagus, generally soon become sufficiently macerated to pass downward. *Large hard bodies* give rise to the most urgent symptoms, such as extreme dysphagia, intense dyspnœa, acute pain, and profound oppression and anxiety. If, as is commonly the case, such a body becomes lodged in the cervical part of the gullet, it may give rise to a swelling in the neck. If the body be not large enough to cause immediate danger, the inflammation which is set up causes considerable fever, and the patient usually wastes rapidly. *Small hard bodies*, if rough or angular, generally give rise to slight dysphagia and a constant feeling of irritation. In some cases, however, there is rather severe spasm of the gullet, so that great difficulty in swallowing is experienced. In other instances, the symptoms, though slight at the time, may ultimately become serious. The following is a case[3] of this kind: A girl, while eating some soup, accidentally swallowed a fragment of bone. The first symptoms soon passed off, but after a time her voice became reduced to a whisper. She became feverish, lost flesh, and had a troublesome cough with thick blood-stained expectoration. At the end of fourteen years, this patient was seen by Gauthier de Claubry, who at first believed her to be in the last stage of phthisis. On pressing her neck, however, he found marked tenderness above the left clavicle. This examination caused an inclination to vomit, and the patient brought up the piece of bone, feeling at the same time a "tearing" pain in the neck. Her health was subsequently completely restored.

Sometimes, however, foreign bodies produce very little irritation, and I may remark that I know of an instance where a halfpenny was retained in the œsophagus for many years without giving rise to much incon-

[1] Loc. cit., p. 66 et seq.
[2] Med. Times and Gazette, January 13, 1883.
[3] Journ. de la Soc. de Méd. de Paris, t. xxiv., p. 13.

venience. From the symptoms it appeared that the coin was pressed laterally against the sides of the œsophagus, in which position it was probably retained by bands of fibrous tissue. A still more remarkable case has been reported by Larrey [1] in which a five-franc piece became impacted in a man's gullet. Propulsion was tried and was thought, both by the surgeon and the patient, to have been successful. The patient, however, suffered afterward from convulsions, and died two months later from meningitis. After death the coin was found fixed perpendicularly about an inch above the cardiac orifice, the rim pressing on the wall of the gullet on each side. The coats of the tube were much thickened at this part, and the pneumogastric nerves were stretched over the edges of the coin. There was spindle-shaped swelling with great redness of both nervous cords, especially of the right one. It is remarkable, however, that the mucous membrane presented scarcely any trace of inflammation.

Analyzing the symptoms in greater detail, the dysphagia, as already indicated, varies to a considerable extent, being sometimes so extreme that even the saliva cannot be swallowed, while in other instances, solids can be taken without much pain. Dyspnœa likewise may be either present or absent, its occurrence being generally due to the large size or angular form of the foreign body. In the former case the interference with respiration may result from direct pressure on the back of the trachea, in the latter from reflex spasm of the glottis. If the dyspnœa be intermittent, it may be inferred that it is of reflex origin. The oppression and anxiety which are caused by the presence of a foreign body in the gullet are characteristic of nearly all acute affections of the œsophagus, and they are sometimes accompanied by cold sweats and syncope. The voice is often greatly modified, and sometimes altogether extinguished. The pain is sometimes described as being of a "bursting" character, and frequently gives rise to straining and unsuccessful efforts at vomiting. In some cases convulsions and even lockjaw [2] have followed the impaction of a foreign body in the gullet. These various symptoms often abate for a few hours, to come on again with additional violence. On the other hand, small smooth foreign bodies may be occasionally lodged in the œsophagus for a considerable time without giving rise to any active symptoms, and it is only when inflammation is set up that they attract attention.

The exact position of a foreign body can often be ascertained by physical exploration. Sometimes it may be possible to use the œsophagoscope, and when this instrument is employed to detect an impacted body, it is better to administer an anæsthetic. In other cases useful information may be obtained by means of the bougie. The sensation caused by the contact of a foreign body with the instrument may be greatly intensified by using Duplay's resonator (vol. ii., Fig. 5, p. 13). By auscultation of the œsophagus in the ordinary way during the act of deglutition, fluid may be heard to strike against the foreign body, while below this point there is either no distinct sound, or only a slight trickling noise can be perceived.

If the foreign body be allowed to remain and the patient survive, a variety of secondary symptoms may arise. In many cases inflammation is set up, and the tissues imprisoning the foreign substance being destroyed by ulceration, it is set free and may be vomited up, or may fall into the stomach. Whether the offending body be extruded or not, however, perforation of the œsophagus is a frequent consequence of the accident.

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[1] Clinique Chirurgicale. Paris, 1829, t. ii., p. 165.
[2] Godinet: Annals de Montpellier, t. iii., p. 230.

Sometimes extensive ulceration takes place in the areolar tissue surrounding the gullet, and a large cavity is formed in the mediastinum. Occasionally the ulceration may extend to the trachea, bronchi, or pericardium, giving rise to acute inflammation of any of these organs. In a case reported by Walshe,[1] the point of a knife had perforated the pericardium and set up pericarditis ; and, in a somewhat similar instance,[2] the entrance of air and particles of food into the pericardial sac through the wound in the gullet had caused the pericardial inflammation to be of a purulent character. Occasionally vessels are laid open, and death ensues from hemorrhage A circumscribed abscess is sometimes formed, and this may point in the neck. Two cases[3] are on record in which the temporary impaction of a foreign body led to rupture of the œsophagus. In one instance[4] a fish-bone, perforating the gullet in the neighborhood of the heart, pierced the pericardium and fixed itself in the middle of the septum after wounding the right coronary vein. When the foreign body penetrates by ulceration into one of the pleural cavities, it generally soon gives rise to empyema, and the offending substance has sometimes been removed by paracentesis. In a case which I saw some years ago with Dr. Turtle, of Woodford, a very careful examination failed to discover a fish-bone which had accidentally found its way into an infant's throat. The baby gradually wasted away, and when it died, at the end of some months, it was found that the fish-bone had passed through the intervertebral substance and wounded the cord. In some instances the foreign body reaches the stomach, or it may pass into the intestines, and cause fatal ulceration in any part of its course ; or perforating into the areolar tissue of the groin or lumbar region, it may give rise to an artificial anus. If, however, the body be small and smooth, it will often pass through the whole intestinal tract, and be got rid of *per rectum* without doing any harm.

Pathology.—Any of the various pathological conditions which have been referred to under the head of Symptoms, such as inflammation, abscess, gangrene, or perforation involving, either the œsophagus alone, the surrounding areolar tissue, or any of the adjoining organs, may be present. Abscesses are especially likely to be formed even a considerable length of time subsequent to the impaction of the foreign body. The interval in Adelmann's[5] cases ranged from a week to fifteen months. In the same series,[6] perforation of the aorta occurred fourteen times, and of the common carotid six times, while the right subclavian and the pulmonary artery were each wounded once.

Diagnosis.—In most cases this is easily arrived at from the history, and, as a rule, it is only when the patients are insane persons or children that any doubt can arise. Under such circumstances the sudden establishment of dysphagia will lead to an examination of the œsophagus, and one of the methods of exploration already described will, in most cases, clear up all doubts. The following example will show the advantage of œsophagoscopy in facilitating the detection and removal of foreign bodies that might otherwise baffle the practitioner's efforts :

Mrs. B., aged fifty-one, was sent to me by Dr. Spitta, of Clapham, in February, 1881. She complained of great difficulty of swallowing and a feeling of something

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[1] Diseases of the Heart and Great Vessels, 1873, fourth edition, pp. 42 and 273.
[2] Ibid., p. 218.
[3] Meyer : Canstatt's Jahresb., 1858, vol. iii., p. 334. Allen : Amer. Journ. Med. Sci., January, 1877, p. 17.
[4] Andrew : Lancet, 1860, p. 186.
[5] Loc. cit., p. 99.
[6] Loc. cit., p. 103.

sticking in her throat. The symptoms had commenced suddenly while she was taking a meal, a fortnight previously. At the first examination with the œsophagoscope, the interior of the gullet was seen to be highly inflamed, but no foreign body could be perceived. At a second sitting, however, a few days later, a flat lamella of bone, about four millimetres square, was detected on the anterior wall of the œsophagus, about two inches below the cricoid cartilage. The bone, together with a small piece of decayed meat, which was adherent to it, was easily removed with forceps. Mrs. B. felt some slight inconvenience for three or four weeks after the foreign body had been taken out, but when last seen she was able to swallow without any difficulty.

Prognosis.—This depends, in the first place, on whether the foreign body is removed or remains fixed in the œsophagus. In the latter case, if the substance be of any considerable size, the prospects of the patient are extremely unfavorable.

Even if the foreign body be quickly ejected, however, inflammation may have been set up which may subsequently give rise to very dangerous complications. Further, when the body has remained long enough *in situ* to cause sloughing, it must not be forgotten that, though relief may be obtained for a time by the expulsion of the offending substance, the patient's life may be brought into jeopardy in the progress of subsequent cicatrization.

Treatment.—In all cases an attempt should be made, in the first instance, to withdraw the foreign body from above *per vias naturales*. This may be accomplished either with the parasol-probang, with Gräfe's coin-catcher, or with forceps. The first-mentioned instrument is by far the most serviceable for small bodies ; Gräfe's snare answers well when a coin is lodged in the gullet ; while the use of forceps is indicated where the body is large and firmly imbedded. The reader is referred to the description of these instruments and the mode of using them already given (vol. ii., pp. 14, 15). Where instrumental treatment has to be adopted, it is often very desirable to administer an anæsthetic. This is especially the case if the foreign body be large, if there be much spasm, or if the patient be nervous or of tender years. Exceptional bodies require exceptional instruments for their removal. In the cases where fish-hooks were swallowed,[1] they were both removed by a very similar procedure, which suggested itself quite independently to two different surgeons, Baud and Leroy, both practising in the Low Countries. Baud did not record his case, which appears to have occurred some time previously to that of Leroy, until the latter surgeon had published an almost identical example of the accident. The mode in which the fish-hooks reached the gullet has already been described under the head of Etiology. In both instances a leaden bullet pierced through the centre was threaded along the fishing line, and allowed to fall by its own weight down the œsophagus till it reached the hook. The further descent of the bullet dragged the hook downward, and thus disengaged it, and its barb having come in contact with the lead, both were drawn up together. Baud employed a ball which had a diameter double that of the hook, while Leroy used a smaller bullet, with a hollow reed attached—an arrangement which he considers assisted in disengaging the hook from the flesh. On the whole, however, Baud's method appears the more simple and efficacious. In another case, reported quite recently by Laurent,[2] a fish-hook was removed from the gullet of a boy who had accidentally swallowed it, by the following plan : A full-sized hollow œsophageal bougie was threaded along the line at-

[1] Leroy : Loc. cit. Baud : Loc. cit.
[2] Lancet., 1882, vol. ii., p. 745.

tached to the hook till it reached the bend of the latter. Gentle pressure with the instrument set the hook free, when the line was tightened, and the bougie withdrawn together with the foreign body.

Formerly emetics were often administered, with the view of effecting the expulsion of foreign bodies, and this measure has often proved successful. I do not recommend this treatment, but there are occasions when it may be desirable to try it. As the patient is unable to swallow, the best mode of producing vomiting is by the subcutaneous injection of hydrochlorate of apomorphia, $\frac{1}{25}$ to $\frac{1}{10}$ of a grain. One grain may be dissolved in fifty minims of distilled water, but as the solution is very unstable it should always be freshly prepared for hypodermic use. Enemata of tobacco have also been used for the same purpose, and, in some instances, with success. In a few cases, intravenous injection of tartar emetic has proved effectual, but this is a dangerous plan. Treatment by emetics has sometimes been attended with success, even in cases where the foreign body has remained in the gullet for a considerable period, but, as a general rule, it cannot be relied upon. Other plans have occasionally been tried. Thus, an instance [1] is on record in which a large soft substance was thought to have been digested in the gullet by the administration of pepsine sixty-eight hours after the accident. Inversion, as already decribed in detail (vol. i., p. 416), may be useful when the body to be dislodged is smooth and heavy. The first recorded instance [2] of inversion for the extraction of a foreign body impacted in the gullet which I have been able to find is in the case of a patient who had swallowed a knife. At his own suggestion, he was several times hung up by the heels in the hope that the knife might fall out by its own weight. His persevering efforts were, however, unavailing, and the knife was removed by gastrotomy. In a case in which the patient was threatened with asphyxia through the impaction of several large pieces of potato in the œsophagus, Dupuytren [3] managed to pinch the gullet with his fingers through the neck, so as to crush the potato and thereby enable it to be swallowed. Langenbeck [4] was on two occasions able, by the same method, to alter the shape of a tough piece of meat sufficiently to allow the impacted morsel in one instance to descend into the stomach, and in the other to be removed through the mouth with forceps. In a case reported by Atherton, [5] the patient herself, an old woman, had attempted, and partly succeeded, in forcing an impacted bone downward by external manipulation.

If it be found impossible to draw up the foreign body, it must either be left *in situ*, pushed into the stomach, or if situated in the cervical portion of the gullet, removed by œsophagotomy. If the patient is able to swallow liquids, it is better, when the foreign body cannot be removed, to leave it alone, in the hope that as soon as the spasm gives way, or the inflammation subsides, the substance may be vomited up. Sucking small particles of ice is sometimes of use in these cases. Large angular bodies, such as false teeth or pieces of bone, should be pushed into the stomach only as a last resource, and when they are impacted in the lower part of the œsophagus. Such bodies cannot remain long in that situation without causing death, and it is therefore better, under the circumstances, to thrust them down, even if some degree of force has to be employed. Propulsion may be most readily effected by means of the ordinary sponge-

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[1] Deutsche Klinik, 1861, p. 109.
[2] Hévin: Loc. cit., p. 595.
[3] Quoted by Luton: Nouveau Dict. de Méd. et de Chir., Paris, 1877, t. xxiv., p. 356.
[4] Loc. cit.
[5] Boston Med. and Surg. Journal, 1870.

probang. Injection of water into the gullet and dilatation of the canal by means of an air-pessary passed down to the foreign body have also been used with success for the same purpose. In the former case the force is applied directly to the foreign body, while in the latter, where an india-rubber bag is inflated with air, the impacted body is probably set free by the forcible expansion of the œsophageal walls. If the body be inconsiderable in size, such as a fish-bone, or a small fragment of the bone of any animal, or even a coin, it is best, if a careful attempt at propulsion has failed, to leave the offending substance undisturbed, provided the patient can swallow sufficient nutriment.

Œsophagotomy is indicated in all cases where, the foreign body being situated in the cervical or the upper part of the dorsal region of the gullet, deglutition is impossible, or there is dangerous pressure on the trachea.

EXTERNAL ŒSOPHAGOTOMY.

History.—This operation appears to have been first suggested by Verduc [1] toward the end of the seventeenth century. About fifty years later Guattani [2] read a paper before the Academy of Surgery of Paris, in which he strongly maintained the practicability of the operation, and gave an account of some experiments on the dead body made with the view of determining the best method of carrying it out, and of some vivisections of dogs undertaken to test the result of such a procedure. External œsophagotomy, however, had at that time been already carried out in actual practice, although the cases had not been published. One operation of the kind had been done for the removal of a foreign body; while another is merely mentioned without any detail.[3] In 1781 a thesis was sustained on the subject by Sue,[4] at Paris, in which he gave the results of some experiments on dogs which had been forced to swallow fragments of bone of such large size that they became impacted in the œsophagus. A few years later Eckholdt [5] proposed to open the gullet between the heads of the sterno-mastoid, a plan which would enable the surgeon to reach the tube quite at the lower part of the neck. This difficult operation has never, I believe, been tried on the living subject. In 1820, Vacca Berlinghieri [6] published an essay, in which he advocated cutting into the œsophagus on a sound previously passed through the mouth as a guide. In 1832 a valuable paper on external œsophagotomy was written by Bégin,[7] who was the first to describe in detail all the steps necessary for opening the gullet with the least possible danger to the many important neighboring structures. Since that time the operation has become a recognized surgical procedure. A full history of external œsophagotomy, with a detailed account of most of the cases recorded in medical literature, was published in 1870 by Terrier [8] in his valuable monograph on the subject.

It would appear from Terrier's [9] statistics that the success of the operation depends in great measure on its early performance, for out of six operations done before the sixth day, only one death occurred, while of five

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[1] Traité des Operations de Chirurgie, Amsterdam, 1739, t. ii., pp. 381, 382. (The original edition was published in Paris in 1693.)

[2] Mém. de l'Acad. Royale de Chir., 1747, t. iii., p. 351.

[3] Both these cases are mentioned in the Mém. de l'Acad. de Chirurgie, 1757, t. iii., p. 14.

[4] Programma de Œsophagotomiâ. Paris, 1781.

[5] Ueber das Ausziehen fremder Körper aus dem Speisekanal. Leipzig, 1799.

[6] Della Esofagotomia. Pisa, 1820. The instrument has already been described in speaking of œsophagostomy (see foot-note 4, p. 49), for which operation it is more useful than for the removal of a foreign body.

[7] Mém. de Med., de Chir. et de Pharm. Milit., 1832, t. xxxiii , p. 241.

[8] De l'Œsophagotomie Externe. Paris, 1870.

[9] Op. cit., pp 116, 117.

cases where it was carried out from the eighth to the thirty-sixth day, three proved fatal. The mode of performing the operation is as follows:

External Œsophagotomy.—The preliminary steps of the operation are similar to those already described under the head of Œsophagostomy (see p. 99). The incision need not, however, be so long as is there recommended, but should be made so that the middle part of it shall correspond to the supposed point of impaction of the foreign body. A special difficulty is likely, according to von Langenbeck,[1] to be encountered in cases where a large foreign body has been impacted behind the cricoid cartilage for several days. Under these circumstances the thyroid body is exceedingly apt to be so much swollen by venous congestion as almost entirely to cover the gullet. To expose that tube, therefore, the thyroid must be carefully raised from it, and for this purpose the capsule of the gland must be incised. When the gullet has been laid bare, the foreign body will in most cases be seen or felt projecting through the wall, which should be nicked with the knife, just sufficiently to permit the impacted substance to be drawn out with forceps. Should it, however, be too small to be felt, a bougie with a metallic or ivory knob should be passed into the gullet by the mouth, or Vacca Berlinghieri's sound may be used. Upon the extremity of one of these instruments an incision should be made in the œsophagus for about half an inch in the direction of the long axis of the tube, care being taken to open it as far back from the trachea as possible, in order to avoid wounding the recurrent nerve. The fact that the gullet has been opened will be rendered apparent by the escape of a considerable quantity of mucus from the wound. If the impacted substance has not already been discovered, it should now be searched for and removed. The edges of the œsophageal wound should afterward be brought together with catgut sutures, the ends of which should be cut off short. If possible, the patient should receive nourishment only by enemata for the first week or ten days, but if this means of sustaining life prove inadequate, a gum-elastic tube must be passed down the gullet beyond the seat of the wound, and food administered through it.

[NEUROSES OF THE GULLET.]

PARALYSIS OF THE GULLET.

Latin Eq.—Imbecillitas gulæ.
French Eq.—Paralysie de l'œsophage.
German Eq.—Lähmung der Speiseröhre.
Italian Eq.—Paralisi del esofago.

Definition.—Loss of power of the muscular fibres of the œsophagus, causing food to lodge in the canal, or to be swallowed with difficulty.

History.—Galen[2] was acquainted with this disease, which he referred to as "imbecillitas gulæ," carefully distinguishing between difficulty of swallowing from this cause and that due to narrowing of the canal itself, or to the pressure of a tumor on its walls. The affection was mentioned by Ætius[3] in the sixth century, but the complaint was not generally recognized till after the middle of the seventeenth century, when our

[1] Loc. cit.
[2] De locis affectis, lib. ii., cap. v.
[3] Tetrabiblos, ii., Sermo ii., c. 33.

own celebrated physician, Willis,[1] published a remarkable case in which he had kept a patient alive for nearly twenty years by teaching him to push his food down with a sponge-probang. The subject was treated of by Stalpaert van der Wiel[2] in 1682, and by Spies[3] in 1727, while Hoffmann,[4] in 1734, described the case of a patient who was obliged to wash down every mouthful of food with water. Some years later van Swieten[5] gave a clear account of the affection, and in 1757 Wepfer[6] recorded several instances in which palsy of the gullet had followed an attack of apoplexy. The subject was discussed, with somewhat less than his usual thoroughness, by Morgagni,[7] and in the early part of the present century Monro[8] published many interesting examples of the complaint. Esquirol,[9] in 1829, described paralysis of the œsophagus as a condition somewhat frequently occurring in lunatics, and occasionally proving the direct cause of their death. In 1833 Mondière[10] treated the subject with his usual erudition, and since then the disease has been more or less fully described in nearly every text-book of medicine.

Etiology.—The affection is met with under three forms—viz., first, where it is due to *central* disease; secondly, where it results from *nerve-pressure;* and thirdly, where it arises from *muscular weakness.* It is obvious, however, that all these conditions, or any two of them, may coexist. As examples of central diseases giving rise to loss of power in the œsophagus may be mentioned hemorrhage into the pons Varolii, or the medulla oblongata, or the development of a tumor in either of these situations, bulbar paralysis, multiple sclerosis, progressive locomotor ataxy, or cerebral atrophy as it occurs in general paralysis of the insane; in short, any condition affecting the "centre of deglutition" may be the cause of the paralytic phenomena. Wepfer[11] has recorded several cases in which the immediate cause of death in persons suffering from apoplexy was inability to swallow, and a very remarkable example of the central origin of œsophageal paralysis has been related by Flaudin[12] in which a patient suddenly lost the power of deglution while at table, the seizure being followed within a few hours by facial paralysis. Larrey[13] published an interesting case in which a lance thrust through the posterior lobe of the left hemisphere of the brain was supposed to have penetrated to the fourth ventricle. The wounded man recovered with the loss of most of his special senses, and with complete paralysis of the pharynx and œsophagus. Esquirol[14] observes that palsy of the gullet is very common in the insane, and that in such patients asphyxia often results from food accumulated in the œsophagus pressing on the trachea. A case is related at the end of this article which well illustrates the effect of pressure by a small clot, probably in the vicinity of the fourth ventricle. Montaut[15] mentions an instance in which œsophageal paralysis was caused by a hydatid cyst at the base of the brain.

As regards peripheral lesions, it is doubtful whether paralysis of one pneumogastric nerve would seriously interfere with the function of the

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[1] Pharm. Rat., part i., sect. 2, cap. i. Oxonii, 1674.
[2] Obs. med. rarior, centur. post, 1682, p. i., obs. xxvii.
[3] De deglutitione læsâ. Helmsted, 1727.
[4] Consult. et respons. cent., t. i., p. 304.
[5] Comment. in H. Boerhaave Aphorismos, Lugd. Batav., 1745, t. ii., p. 701.
[6] Historia Apoplect, Venetiis, 1757, p. 376.
[7] De sedibus et causis morb., ed. secunda, Patavii, 1765, epist. xxviii., art. 14.
[8] Morbid Anatomy of the Human Gullet, etc., Edinburgh, 1811, p. 290 et seq.
[9] Annales d'Hygiène Publique, 1829, No. 1, p. 141.
[10] Archiv. Gén., 1833, t. iii.
[11] Op. cit., p. 376.
[12] Journ. Hebdom., 1831, No. 4.
[13] Recueil de Mém. de Chir., 1821.
[14] Annales d'Hygiène Publique, 1829, No. 1, p. 141.
[15] Quoted by Mondière: Arch. Gén., 2e sér., t iii., p. 43.

gullet, and the conditions are very rare in which both nerves are diseased or pressed upon by diseased structures. As far as I am aware there are no illustrations in recent medical literature of œsophageal palsy resulting from nerve-pressure, but Köhler [1] relates an instance of paralysis in which tubercular infiltration of the bronchial lymphatic glands compressed the pneumogastric nerves, and Wilson [2] met with a case in which the nerves were injured by a syphilitic enlargement of the cervical vertebræ. The exostosis having disappeared under anti-venereal treatment, the power of swallowing was at once recovered.

In these various examples of central and peripheral paralysis, it must be borne in mind that the imperfect action of the muscular fibres of the œsophagus may be due either to a direct *derangement of the motor function* or to *impairment of the sensibility* of the mucous membrane, which accordingly fails to convey the necessary stimulus for reflex action. It is probable, however, that in most instances both the motor and sensory nuclei of the vagus are at fault.

In approaching dissolution the function of the nerve-centre controlling the act of deglutition is extinguished some time before circulation and respiration cease.

In simple weakness the disease is probably in great measure myopathic, but in some cases the muscles may become feeble from impaired innervation. This is the most common form of paralytic dysphagia, and it is met with in persons broken down by ill-health or old age ; it is much more frequently found in men than in women.

In addition to these special causes of paralysis of the œsophagus, there are certain general conditions of the system with which it is often associated, and in which it is hard to determine how far the affection is myopathic or neuropathic in origin. Thus in many of the acute fevers there is difficulty of swallowing, apparently from the imperfect action of the pharynx and œsophagus, but whether this depends on loss of sensibility, derangement of the motor apparatus, or diminished excitability of the "centre of deglutition," it is not easy to tell. It is not improbable, indeed, that the dysphagia in these cases is sometimes mainly mechanical—that is to say, that it arises from mere dryness of the mucous membrane. In diphtheria the affection is generally a neurosis,[3] while syphilis may affect either the medulla or the nerves in some part of their course. In palsy of the gullet arising from lead-poisoning, of which I have met with two examples, the muscular structure is probably most implicated. This variety of poisoning is also said to have occurred through the use of lead gargles.[4]

Ollenroth [5] many years ago described a form of œsophageal paralysis which on three occasions he had observed in nurslings. The onset of the affection was in each case preceded by aphthous eruptions about the corners of the mouth and round the anus. This was followed by rigors and high fever, with vomiting and profuse alvine discharge of a milky-looking fluid without any smell. The whole pharyngo-œsophageal canal next appeared to be stricken with paralysis, and death quickly ensued from collapse. The post-mortem appearances were not recorded, and it is

[1] Quoted by Mondière : Arch. Gén., 2e sér., t. iii., p. 42. [2] Ibid., p. 46.

[3] See Diphtheria, its Nature and Treatment, by the Author. London, 1879, pp. 56, 57.

[4] Hufeland's Journal, 1797, Bd. iii., p. 698. It should be observed that in this case the paralysis was preceded by sharp spasm.

[5] Schmidt's Jahrb., 1837, Bd. xvi., pp. 50–52.

highly probable that these cases were not really examples of paralysis, but of thrush of the gullet (see p. 44).

Though hysteria so frequently gives rise to paralysis of other muscles, it very seldom affects the œsophagus in this way, generally, on the contrary, causing spasm of the tube.

Symptoms.—In all cases of paralysis of the gullet the essential symptom is *dysphagia*, its sudden or gradual development and the degree it attains being dependent on the fundamental cause of the malady. The difficulty of swallowing, though considerable, probably never reaches to the extent of complete aphagia, unless the pharynx is at the same time paralyzed.

As bilateral paralysis of the nerves is extremely rare, and would produce nearly the same œsophageal symptoms as cerebro-spinal disease, two divisions are sufficient for clinical purposes: these are central and local paralysis.

In *central* disease the mode of development depends on the special nature of the medullary lesion; thus, in hemorrhage, the symptom occurs suddenly, and at once attains its maximum intensity. In cases of cerebral tumor the dysphagia becomes gradually developed, while in bulbar paralysis, multiple sclerosis, and locomotor ataxy, œsophageal palsy is a very rare symptom, and, if present, comes on, as a rule, only at an advanced stage of the disease. In general paralysis of the insane dysphagia is more common and occurs at an earlier period. In almost all cases of central origin signs of impaired innervation of the larynx, such as anæsthesia of the mucous membrane or paralysis of the abductor filaments of the recurrent nerve, accompany the œsophageal symptoms. The patient is almost always feeble and depressed, but emaciation is not usually a marked symptom.

In *local* paralysis, the development of the dysphagia is very gradual. I have seen several instances in which the disease has lasted from ten to twenty years. It apparently leads, after a time, to some stenosis of the gullet, and in long-standing cases the *isthmus faucium*, and even the mouth, is often much contracted. In 1875 I had a patient under my care whose mouth had become so reduced in size that it only measured one inch and an eighth across, while the distance between the lips, when parted to the utmost extent, was no more than a quarter of an inch. This patient had suffered from dysphagia for sixteen years, and for the last five years had lived entirely on corn-flour and tea, with a little beef-tea once a week. In this form of œsophageal paralysis, owing to the longer duration of life, emaciation is a much more marked symptom than when the loss of power is due to central disease.

In both varieties important information may be obtained by the employment of the bougie and by auscultation. Certain features are common to both kinds of nervous dysphagia. Thus a bougie can usually be passed easily, and the employment of the instrument does not give rise to so much nausea and retching as in health. Occasionally, however, when the disease has existed for many years, the habitual use of liquids appears to lead to general narrowing of the canal, so that there may be considerable difficulty in passing an instrument. On auscultation the normal œsophageal sound is found to be greatly altered or altogether lost, and the act of deglutition is observed to be markedly prolonged. Hamburger points out that the "morsel" seems to lose its resemblance to the form of an inverted egg, and to assume the shape of a funnel, but I have never been able to verify this refinement of diagnosis. In extreme cases there is

no longer any sound like that of a defined body of fluid passing downward, and all that is heard is a thin stream trickling down drop by drop.

There is seldom any regurgitation in paralysis, but in slight cases, where semi-solids can be taken, patients often complain of the food lodging in the gullet.

Pathology.—The various lesions of the nerve-centres which may be met with after death have already been referred to under the head of Etiology. My own experience in this affection is entirely clinical, and I have never had an opportunity of making an autopsy in a case of either central or local paralysis of the gullet. In most instances there is probably more or less degeneration of the muscular tunic of the œsophagus, and possibly some structural lesion of the nerves themselves.

Diagnosis.—It is important to distinguish paralysis both from spasm and from malignant disease.

In spasm the dysphagia is intermittent, the patient being sometimes able to swallow quite well, while at other times he cannot get down a morsel of food. On the other hand, in paralysis the dysphagia undergoes little, if any, variation. In spasm it is often quite impossible to pass a bougie, while, as already remarked, in paralysis there is seldom any difficulty in using that instrument. In the latter affection there is no regurgitation, but in spasm this is often very marked. The acoustic signs are also quite different; for while in paralysis only a confused gurgling noise is heard, in spasm a sharp click can be perceived, sometimes in one part and sometimes in another. Again, while paralysis more frequently affects the old and feeble, spasm is more often met with in the young and hysterical.

Cancer, like paralysis, is a disease which occurs in the decline of life, but the comparatively rapid progress of malignant disease soon sets the question of diagnosis at rest. Moreover, in cancer there is always obstruction to the passage of a bougie.

Although the diagnosis of œsophageal paralysis is generally very easy, there are some cases where the affection probably altogether escapes observation, owing to the pharyngeal contraction forcing the food through the gullet. For the experiments of Chauveau [1] clearly show that even in complete paralysis of the œsophagus from section of its motor nerves vigorous contraction of the pharynx can impel the food into the stomach. Although Chauveau's observations were made on the horse, it seems reasonable to infer that the almost vertical position of the canal in man would render the passage of food still easier.

Prognosis.—This, of course, depends on whether the disease be local or central. In the simple local paralysis due to muscular weakness, the prognosis is always favorable. Long-standing cases can generally be benefited, and those of shorter duration can be cured. In cases of diphtheria and lead-poisoning the prognosis is very favorable, but when the œsophageal paralysis is due to the coarser forms of nerve-disease, the prospect must always be most grave.

Treatment.—In the more severe forms of paralysis, little can be done in the way of treatment, but in the simple local cases a cure can often be effected. In all cases treatment must be directed to the *fons et origo mali.* In the milder local form of paralysis attention must be paid to the general health, and tonics, such as strychnia, iron, and ergotine, are often of advantage. The patient requires a nourishing and stimulating diet, and a

[1] Journ. de Physiologie de Brown-Séquard, t. v., p. 327.

glass of wine taken at the commencement of a meal acts beneficially both as a local and a general stimulant. Condiments should always be freely taken, and the patient should be encouraged as far as possible to eat solids. Pungent viands are more likely to stimulate the constrictors to reflex action than soft, insipid food. In the way of local treatment topical stimulants, such as a benzoic acid lozenge of the Throat Hospital Pharmacopœia, taken five minutes before eating, will often prove most serviceable. The value of electricity was recognized at an early date, Monro [1] having reported several cases in which the external use of it was followed by marked improvement, and in some by cure.

The best method of applying electricity, however, is by internal faradism. The positive pole being placed, by means of the necklet, in contact with the spinous processes of the upper cervical vertebræ, the negative pole is applied to the interior of the gullet by means of the œsophageal electrode (vol. ii., p. 13). This instrument should be used at least daily, and if possible, several times in the day. The best time for it is before meals. On each occasion the electrode should be introduced three or four times, and retained *in situ* for a few seconds while a succession of shocks are passed. The treatment generally requires to be continued for several weeks, but after the first week or two the application need not be made so often. By this method I every year cure a large number of patients.

Palliative measures must be adopted when those of a more radical character fail, and in connection with this point some hints may perhaps be obtained from cases like that of Willis,[2] already referred to (see History). Baster [3] has also supplied a somewhat similar illustration where a girl, who for fourteen months had fed herself by pushing her food down with a probang, ultimately recovered her power of swallowing. Desault [4] claims to have cured a man by feeding him with a tube, and Sédillot [5] mentions an instance of a young woman whose power of swallowing was completely restored by blisters to the neck, ammonia liniment, and gargling and swallowing mustard-and-water.

The following is a remarkable illustration of œsophageal palsy dependent on a central cause :

Master W. B. C., aged sixteen, of Utica, N. Y., was brought to me [6] on June 18, 1880. Besides the usual ailments of childhood, he had suffered at various times from "croupy" attacks, but for the three or four years preceding the onset of the complaint for which my advice was sought, he had enjoyed uninterrupted good health. In May, 1879, while playing at base-ball, he noticed that whenever he threw the ball a sharp pain seemed to shoot through the region of the larynx. This pain was of only momentary duration, but for several days afterward he had frequent tingling, shooting sensations down the left arm from the shoulder to the wrist. He continued, however, to play ball daily, and on one occasion, about a fortnight after the occurrence of the laryngeal pain mentioned above, he became conscious, while *greatly excited* in the middle of a game, that he had some difficulty in swallowing.[7] That evening it cost him some effort to eat his supper, and on the following day the dysphagia had become

[1] Morbid Anatomy of Gullet, etc. Edin., 1830, second edition, p. 290.

[2] Pharmaceutice Rationalis, part i., sect. 2, cap. i.

[3] Referred to by Stalpaert van der Wiel: Observ. Med. rarior, cent. 2, part i., obs. xxvii.

[4] Œuvres Chirurg. Paris, 1801, t. ii., p. 291.

[5] Recueil Périodique, t. xl , p. 81.

[6] The patient had previously been seen by Dr. Elsberg, to whom I am indebted for some information respecting the beginning of the malady.

[7] A few days previously he had taken a large quantity of ice-water while heated, and had eaten some ice-cream, but this does not seem to have had any causal relation with his malady.

so great that he could only swallow liquids, which, however, were occasionally thrown back through the nose. About the same time Master C. was attacked with almost constant hiccough, and his voice acquired a nasal twang. Dr. Gray, of Utica, was called in, and found it necessary to feed him with the help of a stomach-tube during three weeks. The patient then somewhat recovered his power of swallowing. In July, 1879, he had a fit of dyspnœa, followed by several similar paroxysms during the autumn. The difficulty of breathing gradually grew more persistent, and in January, 1880, the number of respirations had fallen to six per minute. Tracheotomy was performed about this time by Dr. Hutchinson, of Utica, and Master C.'s breathing was relieved, but his dysphagia did not improve. He gained weight, however, and his general condition was fairly satisfactory, but his left arm remained weak and somewhat numb, and he became partly deaf in the left ear.

When I saw Master C. I found him wearing a tracheotomy tube, but he was able to breathe fairly well when its orifice was closed with a cork. His voice was rather feeble and slightly nasal (from imperfect action of the uvula). His left arm and left leg were weak, and his power of grasp with the left hand was decidedly less than normal. He walked in a somewhat unsteady way, and when his eyes were closed his movements resembled those of a patient suffering from locomotor ataxy. On the left side he could not hear a watch tick at a greater distance than nine inches from the ear. On the right side the hearing was perfect.

On inspecting the pharynx, the uvula was found to possess diminished sensibility, but was not drawn to either side. On laryngoscopic examination the vocal cords appeared to act imperfectly as regards abduction, adduction, and tension. The abductors, however, were chiefly affected, the utmost separation of the vocal cords in forced inspiration affording an opening only about one-third of the normal size. There was also diminished sensibility of the mucous membrane of the larynx. On directing the patient to swallow some water, the act of deglutition was seen to be very slowly and imperfectly performed.

Having treated several somewhat similar cases in conjunction with Dr. Hughlings Jackson, I requested him to see the patient with me, and the following is his report: "Disks normal, retinal veins strikingly irregular, patellar-tendon reflex quite absent." Dr. Hughlings Jackson thought that there was a small tumor pressing on the medulla. I venture to suggest that rupture of a small artery in the medulla took place during the violent exercise in which the boy was engaged, and that the subsequent development of the symptoms was due to sclerotic changes in the clot.

It need scarcely be said that I was unable to recommend the removal of the tracheotomy tube in this case, but while pointing out that no very remarkable results could be anticipated from treatment, I suggested that local faradism and galvanism might be tried on alternate days. This treatment was carried out by Dr. Ford, of Utica, who forwarded the following report in October, 1880, after he had pursued the treatment for a short time: "I have applied electricity as you suggested, and observe that the parts are vastly more sensitive to electricity, but there is as yet no appreciable increase of motion." Dr. Hutchinson, of Utica, was good enough to send me, quite recently (December 5, 1882), some notes which bring the case almost down to the present time. "I saw the patient yesterday," he says, "and found him quite strong and in apparent good health. He still wears the tube, although he can breathe for some time with it closed. As he inspires the nose contracts and becomes pinched, and he breathes with some effort. He has still difficulty in swallowing, and does not like to be seen at the table by strangers. He is still uncertain with his left arm and leg, and has fallen from his horse because he could not keep his left foot in the stirrup."

SPASM OF THE ŒSOPHAGUS.

(Synonym: Œsophagism.)

Latin Eq.—Spasmus œsophagi.
French Eq.—Spasme de l'œsophage.
German Eq.—Krampf der Speiseröhre.
Italian Eq.—Spasmo del esofago.

Definition.—Rigid approximation of the walls of a segment of the œsophagus through contraction of the circular fibres of its muscular coat, giving rise to dysphagia, varying in intensity and duration.

History.—The affection was referred to by Hippocrates,[1] but only in a casual manner, and no other ancient writer seems to have been acquainted with it. In more modern times van Helmont[2] pointed out that difficulty of swallowing sometimes occurs in hysterical women, but he was under the impression that the symptom was due to an actual rising of the womb to the throat, which he thought caused temporary obliteration of the œsophageal canal. It was not till the early part of the eighteenth century that the disease was really made the subject of rational investigation by Hoffmann,[3] and little has been added since his time to the clinical knowledge of the affection. A short essay on "Spasmodic Disease of the Gullet" was published by Courant[4] in 1778, and a few years later Bleuland[5] briefly discussed the malady in the little treatise which has been already several times referred to, and in particular pointed out that spasm of the gullet is sometimes produced by the irritation of the neighboring inflamed part, *e.g.*, by gastritis.[6] Several interesting examples of the disease were related by Monro,[7] and the subject also was treated of by Mondière.[8] A very full account of spasm of the gullet was given by Follin,[9] and more recently Hamburger[10] published an accurate account of the affection. A paper containing some important hints as to the diagnosis of the affection was written by Roux[11] in 1873, while soon afterward some good examples of the complaint were reported by Foot,[12] and an important clinical lecture on the subject was published by the late Maurice Raynaud.[13] More recently the disease has been discussed in some detail by Zenker[14] and by Brazier,[15] while it has also been fully dealt with in recent volumes of the "Nouveau Dictionnaire de Médicine et de Chirurgie,"[16] and the "Dictionnaire Encyclopédique des Sciences Médicales.[17]

Etiology.—Spasm of the œsophagus occurs more commonly in the female than in the male sex. It is most frequent in young women between the ages of eighteen and thirty, but it is often met with later in life, and sometimes, though very rarely, it occurs in childhood. I have twice seen it in patients under ten years of age. The affection, or at any rate the nervous constitution which predisposes to it, is occasionally hereditary. In May, 1875, I succeeded in curing a patient whose mother and grandmother had both suffered from the same complaint. A case has also been reported by Stevenson,[18] in which he successfully treated a mother and her daughter for spasm of the gullet, the former having suffered from the complaint for twenty years, and the latter, aged twenty, all her life. When men are the subjects of œsophagism they are always of a highly emotional temperament, and are generally victims of hypochondriasis.

Spasm of the œsophagus may be (1) a mere psychical or hysterical

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[1] De Morbis, Littré's edition, l. iii., c. xii., vol. vii., p. 133.

[2] Ignot. Act. Regim., § 43. Joannis Baptistæ van Helmont: Opera Omnia, Francofurti, 1707, p. 322; also Asthma et Tussis, § 31, ibid., p 292, where he relates a case in which a woman had hardly swallowed anything for three months. He adds, "I came, recognized the disease, and immediately the Lord cured her," but van Helmont unfortunately omits to state *how*.

[3] De morbis œsophagi spasmodicis in F. Hoffmanni, Op. Omn. Phys. Med., Genevæ, 1740, t. iii., p. 132.

[4] De nonnullis morbis convulsivis œsophagi. Montpellier, 1778.

[5] De sani et morbosi œsoph. structurâ, Leidæ, 1785, p. 56.

[6] Ibid., p. 62.

[7] Morbid Anatomy of the Human Gullet, etc., Edinburgh, 1811, p. 223; and second edition, 1830, p. 268 et seq.

[8] Œsophagisme, Archiv. Gén., 1833, t. i., p. 465.

[9] Rétrécissements de l'Œsophage, Paris, 1853, p. 154 et seq.

[10] Klinik der Œsophaguskrankheiten, Erlangen, 1871, art. iv., p. 94 et seq.

[11] Diagnostic des Rétrécissements Spasmodiques de l'Œsophage, Thèse de Paris, 1873.

[12] Dublin Journ. of Med. Sci., April, 1874.

[13] Annales des Maladies de l'Oreille et du Larynx, 1877.

[14] Ziemssen's Cyclopædia of Pract. Med., 1878, vol. viii., p. 204.

[15] Contribution à l'Étude de l'Œsophagisme, Thèse de Paris, 1879

[16] Paris, 1877, t. xxiv, p. 359.

[17] Paris, 1880, 2e partie, t. xiv., p. 529.

[18] Med. and Phys. Journ., vol. viii., p. 35.

phenomenon, or (2) it may occur in the course of certain nervous disorders, such as chorea, epilepsy, and especially hydrophobia ; or (3) it may be due to some reflex irritation, the cause of which may be either in the gullet itself, or at a distance from that part ; or (4) it may result from the strain of violent retching. Of the psychical causation of this malady, the most striking example is to be seen in the case of patients who imagine that they are suffering from hydrophobia. A remarkable instance[1] of this is the case of a man who, on returning to France after an absence of twenty years, was told that his brother had died from the effects of the bite of a dog by which he had himself been bitten. Shortly after hearing this news of his brother, he was seized with œsophageal spasm, which quite prevented him swallowing and ultimately proved fatal. A case is also related[2] of a man who was bitten by a favorite dog, which soon afterward ran away. The master showed all the signs of hydrophobia until the dog returned, perfectly well, nine days after, when the man instantly recovered. Another remarkable example is related by Dr. Dolan,[3] on the authority of Trousseau, in which a man showed the characteristic signs of hydrophobia after a rabid dog had *tried* to bite him. The symptoms had come on after a feast, and vanished on his being made to vomit.

In the severe nervous diseases to which reference has been made, such as tetanus and epilepsy, the œsophagus sometimes participates in the spasm which affects so many of the other muscles of the body. In chorea, spasm of the gullet is less frequent, but I have seen two examples of this complication. In true hydrophobia, the muscles of the pharynx and œsophagus are specially involved.

Setting aside foreign bodies, the most frequent topical source of reflex irritation of the gullet is probably to be found in a gouty condition of the blood. Brinton,[4] who first called attention to this source of irritation, was of opinion that in lithæmia the acid condition of the blood causes spasm of the œsophagus, in the same manner that it produces cramp in the legs, or numbness and formication in various parts of the body. The immediate cause of the œsophageal spasm in these gouty cases often appears to be the eructation of acid matters. Among the reflex causes acting at a distance, diseases of the stomach and affections of the uterus may be mentioned. Of the former, Howship[5] has recorded two remarkable examples. One of these was that of a man who had been treated with bougies for four months on account of stricture of the middle third of the œsophagus. After death no stricture was found, but the stomach was in a state of "fungous ulceration for a hand's breadth." In another case, a lady, aged sixty-nine, suffered from spasmodic stricture of the upper part of the gullet, which was relieved by the passage of bougies. The patient, however, still continued to vomit a glairy fluid, and ultimately sank from exhaustion. At the post-mortem the stomach was found to be a mass of scirrhus, while the œsophagus was perfectly healthy. A similar case has been reported by Monro.[6] Another instance was related by John Shaw,[7] in which he had treated a patient for organic stricture of the œsophagus. After death the dysphagia was found to have been caused by ulceration of the larynx. The

[1] Bibliothèque Med., t. xxxix., p. 234.
[2] Dict. Encyclop. des Sci. Méd., t. xiv., p. 530.
[3] Quoted, with many other illustrations, by Dr. Dolan in his admirable Report on Rabies or Hydrophobia (pp. 82, 83), as Commissioner for the Medical Press and Circular, 1878.
[4] Lancet, 1866, pp. 2 and 253.
[5] Practical Remarks on Indigestion. London, 1825.
[6] Op. cit., p. 266.
[7] Lond. Med. and Phys. Jour., vol. xlviii., p. 185.

affection has been known to be caused by metritis, and to disappear on the cure of that disease.[1] I have myself met with two patients who always suffered from œsophageal spasm when pregnant, but were relieved immediately after parturition. As an analogous case, I may mention that I formerly treated a lady in whom the spasm came on while she was suckling. This recurred to such an extent at the birth of each child that she was never able to nurse. The case reported by Bettali,[2] in which the presence of a tapeworm in the intestinal canal gave rise to spasm of the œsophagus, and that referred to by Bouteille,[3] in which the affection was caused by the existence of worms in the ear, may be mentioned as other examples of reflex action. There are two cases on record in which the spasm is said to have resulted from vomiting. One is related by Sir Everard Home,[4] in which a lady, after severe sea-sickness, was quite unable to swallow owing to spasmodic contraction of the gullet. From the description of the symptoms, however, I am disposed to believe that this was really a case of acute inflammation. The other, which is mentioned by Carron,[5] is more to the purpose. Here, intense spasm followed sickness induced by the use of emetics. An extraordinary case of an opposite character is mentioned by Home,[6] of a young man in whom difficulty of swallowing, apparently spasmodic in character, which had existed since childhood, was *relieved* for weeks at a time after violent retching.

As regards the actual mechanism of spasm, Dr. Andrew Smith[7] has advanced the following ingenious hypothesis: "In normal deglutition," he observes, "the contact of the bolus with the mucous membrane of the gullet produces an impression which is reflected to the muscular coat at a point *above* the mass which is being swallowed, and thus the resulting wave of contraction follows immediately after the bolus and forces it downward. But in spasm of the œsophagus, it would seem that the excitation is reflected to a point *below* instead of above the bolus, so that the resulting contraction presents an effectual obstacle to the passage of the alimentary mass, or even forces it upward."

Symptoms.—Dysphagia is always complained of. It varies in intensity from a slight feeling of difficulty in performing the act of deglutition, which can be overcome by an effort of the will, to an almost total inability to swallow. In slight and recent cases, solids or semi-solids are swallowed more easily than liquids, but as the disease becomes more established fluids pass the more readily, and warm drinks can be taken with less trouble than cold ones. The dysphagia is also, as a rule, more or less paroxysmal, occasionally coming on in the middle of a meal, but sometimes it lasts, with slight intermissions, for months, or even years.

Seney[8] relates a case in which the morsel of food was seized in the œsophagus and could neither be swallowed nor rejected, the most severe cramp being felt at the same time in the throat. This is a rare symptom, and, so far as I am aware, it has not been mentioned by any other writer. I have myself never met with an example of this kind of spasm.

In cases of spasm the patient not only cannot swallow, but generally has very little inclination for food. Regurgitation is sometimes present, and when it does occur, it comes on instantaneously after swallowing,

[1] Archiv. Gén., t. xxxi., p. 474.
[2] Quoted by Mondière: Arch. Gén., 1833, vol. i.
[3] Ibid.
[4] Op. cit., p. 549.
[5] Recueil Périodique, t. xl., p. 58.
[6] Op. cit., p. 550.
[7] Virginia Med. Monthly, 1877, vol. iii., No. 34, p. 743.
[8] Œsophagisme Chronique, Thèse de Paris, 1873.

there being no appreciable interval as in organic stricture. The food, under these circumstances, is sometimes rejected with so much force that it is thrown quite out of the mouth. Slight odynphagia may be complained of, and an uneasy sensation, or even a little pain may occasionally be felt between meals. Sometimes the sufferer experiences the well-known feeling of a "ball rising in the throat." Hamburger[1] indeed believes that "globus hystericus" consists in a wave of spasm affecting successive segments of the gullet from below upward. He observes that if a patient can be examined with the stethoscope at the moment she experiences the sensation of "the ball" rising, a sudden contraction of the œsophagus and the ascent of a bubble of air will be heard. On the other hand, Rosenthal[2] found in two cases that galvanization of the hypoglossal nerve immediately inhibited the spasm of the œsophagus; and he considers that the fact that the patient can swallow while the "globus hystericus" is felt proves that the phenomenon cannot be due to cramp of the œsophageal muscles. A case, however, has recently come under my notice which directly controverts the last statement. The patient, a lady, aged sixty-two, whom I saw in consultation with Mr. Buée, of Slough, has been suffering on and off for several months from spasm of the gullet. She often went several days without swallowing a particle of food or drinking a drop of liquid. I saw her make the attempt, but violent coughing at once came on from the drink passing into the windpipe. When the spasm relaxed, however, the patient was able to swallow easily. She stated of her own accord that the sensation in the throat was like a ball—in fact, like "hysteria," as she had experienced it when a girl. The patient also assured me, *proprio motu*, that as long as this sensation lasted nothing would go down the throat.

Emaciation is often altogether wanting, and never bears any proportion to the duration and apparent severity of the obstruction; often, indeed, well-nourished women are met with who declare that they cannot swallow at all. Expuition only occurs when the spasm is very severe, both as regards intensity and duration. There is seldom any alteration of the voice or cough, except when the spasm of the gullet is reflected from the larynx.

Auscultation of the œsophagus often affords valuable information. Thus *the point of obstruction may be heard to vary in situation.* The first morsel may be arrested or retarded at the upper part of the œsophagus, while the second or third morsel is stopped two or three inches lower down; or while the act of deglutition is arrested or delayed one moment, it may be performed perfectly the next. This is an absolute proof of the spasmodic character of the affection. Again, the morsel may be heard to be arrested or forced upward for a second and then to pass down the gullet. There is generally not nearly so much of the bubbling or gurgling sound as is met with in organic stricture or œsophageal diverticula. On passing a bougie, an obstruction will generally be felt in the region prone to be contracted, which is usually near the upper or lower orifice of the gullet, but much more frequently the former. The obstruction can often be overcome by moderate force, but sometimes the spasm is so tight that it will not yield to anything short of violence. In such cases repeated attempts should be made on different occasions to pass the instrument. Sometimes a rapid attempt to introduce it will succeed when a slower one fails, but more often the spasm gives way before steady pressure. If the

[1] Klinik der Œsophaguskrankheiten, Erlangen, 1871, 4. art., p. 94.
[2] Handbuch der Diagnostik und Therapie der Nervenkrankheiten, p. 245.

patient be placed fully under the influence of an anæsthetic, all difficulty in using the instrument will disappear. It may be remarked here that in some cases the passage of the bougie causes great pain, a phenomenon probably dependent on the existence of extreme congestion of the lining membrane.

Diagnosis.—The age, sex, and nervous temperament of the patient are of help in arriving at an accurate diagnosis. The abrupt commencement and intermittent character of the dysphagia, the suddenness of regurgitation (when it occurs), the fact that in most cases the obstruction can be overcome with the bougie, and the absence of emaciation, are the salient features. In paralysis of the gullet, the dysphagia is *constant*, and in malignant disease it is nearly always *progressive*.[1]

Pathology.—The affection consists essentially of a spastic contraction of the circular fibres of the muscular coat of the œsophagus. Its more frequent occurrence at the extremities of the tube is explained by the greater abundance and higher development of the circular fibres in those situations.

A perverted or unstable condition of the nervous centres is doubtless necessary for the production of the affection, and hence the complaint occurs in connection with hysterical and other nervous disorders.

Although it is highly probable that whenever muscles are repeatedly thrown into a state of spasmodic contraction, both myopathic and neuropathic changes ensue, yet such morbid alterations of structure have not hitherto been observed. Even in hydrophobia, there is seldom any appreciable change to be seen in the condition of the œsophageal canal. In tetanus, Larrey[2] found the œsophagus and pharynx tightly contracted after death.

Prognosis.—The prognosis is generally favorable in recent cases, but where the disease is of very long standing, like many other nervous affections it becomes intractable. It is apt to lead to narrowing of the œsophagus, and may sometimes predispose to cancer or determine the site of its development. Even when the disease is of only moderately long duration the cure is often protracted, and relapses are apt to occur.

Cases have been reported which have resulted in death, though no disease could be found in the œsophagus. Mr. Power[3] has related a remarkable instance which was seen by several eminent members of the profession, in which the spasm was sufficiently severe to destroy the patient, a man aged forty-eight, by inanition, and yet after death no organic lesions whatever, in or around the gullet, could be found to account for the symptoms. A case has also been recorded by McKibben,[4] in which death occurred in five days, spasm of the gullet, with absolute aphagia and profound prostration of the nervous system being the only marked symptoms. There was no obstruction, and a stomach-tube could be easily passed, but the utmost efforts of the patient to swallow were quite unsuccessful. The

[1] It might be extremely difficult to distinguish true spasm from the condition known as *dysphagia lusoria*. This is generally said to arise from the compression to which the gullet is subjected by the right subclavian artery when, as an abnormality, it springs from the arch of the aorta. In its course from the left to the right side of the chest, the vessel must of necessity pass either in front of, or behind the gullet, which may thus be pressed on. More or less intermittent dysphagia will in this manner be produced. The existence of this form of dysphagia is, however, altogether denied by some writers.

[2] Mém. de Méd. Chir. et Pharm. Milit., t. xiv., p. 175.

[3] Lancet, 1866, vol. i., p. 252.

[4] Amer. Journ. Med. Sci., October, 1859. Quoted by Andrew Smith: Loc. cit.

case, however, is very incompletely reported, and no autopsy was made. It seems highly probable that paralysis rather than spasm was the cause of the dysphagia.

Treatment.—When the affection depends on serious disease of the general nervous system, the attention of the practitioner must be directed to the fundamental lesion. Thus, in hysteria the patient must be braced up by moral, as well as by hygienic and medicinal agencies. His mind should, if possible, be kept employed by regular and interesting occupation, or by change of scene and travel. By passing a bougie, and assuring the patient that there is no obstruction, such persons may sometimes be made aware of the groundlessness of their sensations. If the disease is believed to be of reflex origin, the cause must be sought out and if possible removed. Where the affection results from a gouty condition, an alkaline draught containing bicarbonate of potash and aromatic spirits of ammonia will often at once give relief. Other drugs are sometimes of great service. I have employed bromide of potassium with marked benefit in several cases, and it has also been found useful by Gubler [1] and Amory,[2] but valerianate of zinc in combination with assafœtida has proved even more effectual. In many cases the passage of bougies lessens the irritability of the canal and speedily brings about a cure, and it may be remarked that, as a rule, the ivory-knobbed bougies answer better for the purpose than the ordinary gum-elastic instrument. The bougie, which must be warmed, should either be kept *in situ* for a minute or two, or it should be slowly moved up and down the gullet; but it should not be used when there is hyperæsthesia of the mucous membrane. Under such circumstances it is better to treat the case at first with injections. Various mineral astringents, such as chloride of zinc or perchloride of iron, may be used, but a weak solution of nitrate of silver (gr. v. or gr. x. ad. ℥ j.) answers best. The solution should be warmed, and about half a drachm injected into the gullet with the "œsophageal injector" (Fig. 4, p. 13) as nearly as possible at the seat of spasm. Three of four injections made on alternate days will often effect a cure, or they will relieve the irritability so much that bougies can subsequently be employed. Broca [3] cured a patient by forcibly opening the stricture with a dilator, but I believe that his case would have yielded to bougies. If, however, mechanical measures do not succeed, galvanism will almost invariably conquer the disease. Indeed, this remedy is so certain, that, if ordinary medication fails, I at once have recourse to it. A ten- or twelve-celled battery should be used. The œsophageal electrode should be introduced into the gullet at least once a day, and kept in position for a minute or two or longer if the patient can bear it. The application should be made at such a time that a considerable interval may elapse between the treatment and the next meal. After a week or ten days, the application should be made on alternate days for a fortnight, when the cure will generally be complete.

The dietary in these cases is of the greatest importance. If the spasm is very severe, thickened liquids should be given, and it is well to bear in mind the fact, which has been already pointed out, that warm drinks are much less apt to bring on spasm than cold ones. It is remarkable, too, that in nine cases out of ten if the drink be sweetened it is better borne. Gradually the food may be thickened, and panada may be allowed. If

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[1] Bull. Gén. de Thérap., 1864, t. 67, pp. 10, 11.
[2] Dict. Encyclop., vol. xiv., p. 538.
[3] Gazette des Hôpitaux, August 7, 1869.

the case progresses favorably, the patient will be able to return by degrees to ordinary diet. Stimulants should not as a rule be given, and all *pungent* food should be prohibited. It is the greatest mistake to force these patients to take solid food before the cure is complete. They may sometimes be tricked out of their malady when it is slight and recent, but rough measures always fail.

MALFORMATIONS OF THE GULLET.

Latin Eq.—Deformitates ingenitæ œsophagi.
French Eq.—Vices de conformation de l'œsophage.
German Eq.—Missbildungen der Speiseröhre.
Italian Eq.—Vizi di conformazione del esofago.

Definition.—Congenital irregularities in the formation of the œsophagus, resulting in an excess, a deficiency, or an imperforate condition of that tube. The first-named anomaly is exceedingly rare, and is only met with in disomatous monsters. Deficiency of a part of the œsophagus, generally affecting the middle third, together with an abnormal communication between the gullet and the trachea or one of the bronchi, is the most common deformity, and though met with in monsters and still-born children, is most frequent in infants who are born alive, but survive only a few days. The other deformities are too rare to require definition.

History.—In all probability, malformations of the œsophagus are of rare occurrence. All the recorded cases which I have succeeded in collecting amount to no more than sixty-two, and I am able to add only one from my own observation. These facts are especially significant when we remember that the condition, in viable infants at least, is attended by such striking symptoms that it is hardly possible for them to escape notice, while the inevitably fatal result always affords an opportunity of investigating their cause. At the same time, it must not be forgotten that Hirschsprung himself personally observed four examples of the condition in less than seven months in a town of only 180,000 inhabitants, and that within three weeks Ilott met with two cases in a country district near London. It is, indeed, possible that if still-born infants, and especially monsters, were more uniformly submitted to careful dissection, malformations of the œsophagus would be found more frequently than the small number of published cases would lead us to suppose. The earliest recorded instance of œsophageal deformity appears to be that related by Durston in 1670.[1] Two cases were published by Blasius[2] in 1674, in one of which the tube bifurcated and again united, while in the other there was saccular dilatation of the gullet at its lower end. In 1791 an instance was recorded by Tenon,[3] in which there was membranous obstruction of the gullet in its upper part. In 1810 Brodie[4] reported a case in which there was blind termination of the tube, and a few years later Lozach[5] published an example of complete absence of the organ. In 1821 Martin[6] published an example of deficiency of a portion of the œsophagus, with intercommunication between the alimentary and respiratory tracts. It was not, however, till 1861 that the literature of the subject was collected. In that year, Hirschsprung,[7] in a small work of considerable merit, brought

[1] Collect. Academ., partie étrangère, 1670, t. ii., p. 288.
[2] Observ. med. rarior, Leidæ, 1674, tab. vi., fig. 5.
[3] Fourcroy: La Médecine éclairée par les Sciences, 1791, t. i., p. 301.
[4] For the scanty particulars of this case the reader is referred to the French Biblioth. Méd., 1810, t. xxx., p. 381, as I have been unable to find the original article.
[5] Journ. Univ., 1816, t. iii., p. 187.
[6] Exposé des Trav. de la Soc. Roy. de Méd. de Marseille, 1821, p. 44.
[7] Den Medfodte Tillukning af Spiseroret. Copenhagen, 1861.

together ten cases of the affection, and further elucidated it by four examples which had come under his own notice. Since then, several fresh cases have been placed on record, while many others have been discovered in the annals of medical literature, and the following synopsis, I think, represents with a fair degree of completeness the facts published up to the present date.

Of complete deficiency there are five cases on record, viz., those of Lozach,[1] Sonderland,[2] Mellor,[3] Heath,[4] and a specimen in the Museum of the Army Medical Department at Netley.[5]

Of blind termination there are nine examples, viz., those of Durston,[6] Brodie,[7] Roederer,[8] Marrigues,[9] Lallemand,[10] Van Cruyck,[11] Pagenstecher,[12] Warner,[13] and Pinard.[14]

Of cases in which there was an intercommunication between the œsophagus and air-passages, with deficiency of a portion of the former, or, as they have been called, "inosculating" cases, there are 43, the communication being with the trachea in 40, and with one of the bronchi in 3. The former category includes the cases of Martin,[15] Houston,[16] Padieu,[17] Schöller,[18] Davis,[19] Tilanus,[20] Levy,[21] Gernet,[22] Luschka,[23] Cruveilhier,[24] Ayres,[25] Ogle,[26] Ward,[27] Willigk,[28] Steenberg,[29] Hirschsprung[30] (three cases), Maschka,[31] Bendz,[32] Boucher,[33] Annandale,[34] Luschka,[35] Porro.[36] Sundewall,[37] Périer,[38] Polaillon,[39] Ilott[40] (two cases), Lehmann,[41] Westbrook,[42] and Mackenzie,[43] together with specimens in the museums of the Royal College of Surgeons of Ireland,[44] of the Boston Society of Medical Improvement[45] (two cases), of the Army Medical Department at Washington,[46] and of the Royal College of Surgeons of England[47] (three cases).

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[1] Journ. Univ., 1816, t. iii., p. 187. [2] Hufeland's Journal, August, 1820.
[3] Lond. Med. Gaz., June 26, 1840, vol. xxvi., p. 542.
[4] Ibid. (Mellor's case is given in detail, but Heath's is only briefly referred to.)
[5] Catalogue of the Museum Army Med. Dept., 1845, p. 385.
[6] Collect Academ., part. étrang., 1670, t. ii., p. 288.
[7] Bibl. Méd., 1810, t. xxx., p. 381.
[8] Meckel: Handbuch d. pathol. Anatomie, Leipzig, 1812, Bd. i., p. 494. [9] Ibid.
[10] Observations pathologiques propres à éclairer plusieurs points de physiologie. Paris, 1816. [11] Bull. de la Soc. Méd. d'Émulation de Paris, 1824, p. 251.
[12] v. Siebold's Journal f. Geburtshülfe, etc., 1830, Bd. ix., p. 112.
[13] Lancet, 1839, vol. ii. [14] Bulletin de la Soc. Anat., 1873. [15] Loc. cit.
[16] Dublin Hosp. Rep., 1830, vol. v., p. 311.
[17] Bulletin de la Soc. Anat., 1835, t. x., p. 95.
[18] Neue Zeitschrift f. Geburtskunde, Berlin, 1838, vol. vi., p. 2.
[19] Lond. Med. Gaz., January 13, 1843, vol. xxxi., p. 543.
[20] Verh. van het Genootschap d. Genees en Heelk. te Amsterdam, 1844.
[21] Neue Zeitschrift f. Geburtskunde, Berlin, 1845, vol. xviii., p. 436.
[22] Oppenheim's Zeitschrift, 1847, p. 378.
[23] Virchow's Archiv, 1848, vol. xlvii., p. 178.
[24] Traité d'Anat. Pathol. génér., Paris, 1849, t. ii., p. 232.
[25] Trans. Path. Soc., 1852, vol. iii., p. 91.
[26] Ibid., 1856, vol. vii., p. 52. [27] Ibid., 1857, vol. viii., p. 173.
[28] Prager Vierteljahrschr., August 13, 1856, p. 34.
[29] Hirschsprung: Op. cit., p. 37. [30] Ibid., pp. 39–50.
[31] Allg. Wiener Med. Ztg., 1862, No. 9, p. 78.
[32] Ugeskrift for Lager, 1867. [33] Bulletin de la Soc. Anat., 1868.
[34] Edin. Med. Journ., January, 1869, vol. xiv., p. 598.
[35] Virchow's Archiv, 1869.
[36] Annali Universali di Medicina, Milan, 1871, t. ccxvii., p. 421.
[37] Upsala Lakaref6r-mings Tórhandlinger, 5te Bandel, 5te Häftet.
[38] Union Médicale, 1873, No. 145, p. 894.
[39] Gaz. des Hôpitaux, July 17, 1875.
[40] Trans Path. Soc., Lond., vol. xxvii., p. 149.
[41] Schmidt's Jahrb., Bd. cxlviii., p. 269.
[42] Annals of the Anat. and Surg. Soc. of Brooklyn, 1879, vol. i., pp. 98, 99.
[43] Published in detail at the end of this article.
[44] Catalogue Roy. Coll. Surg., Ireland. Anatomy, vol. i., p. 152. Dublin, 1834, Spec. Ga. 53.
[45] Catalogue Boston Soc. of Medical Improvement. Specs. Nos. 456 and 457, p. 128.
[46] Catalogue Mus. Washington, D. C., 1867.
[47] Catalogue Mus. Roy. Coll. Surg., Eng. Teratological series. London, 1872. Specs. 394, 395, 396.

The three cases in which there was a communication with one of the bronchi are those of Levy,[1] Hirschsprung,[2] and an example in the Dupuytren Museum at Paris.[3]

Of intercommunication between the œsophagus and trachea (the œsophagus being otherwise normal) there are two cases, viz., those of Lamb[4] and Pinard.[5]

Of membranous obstruction there are two cases in which the œsophageal canal was completely blocked up, viz, those of Rossi[6] and Tenon;[7] and one in which a valve-like opening allowed food to pass with difficulty. In the case of Rossi the obstruction was just above the cardia, and the infant died on the third day; Tenon's case was similar, but the obstruction was in the upper part of the œsophagus. In the remaining case it is highly probable, although not absolutely certain, that the malformation was congenital.

The following are the particulars:[8] An old woman had manifested great difficulty in swallowing *from early infancy*. Œsophageal vomiting came on when she attempted to take food otherwise than in very small morsels. After death a dilatation of the gullet was found. About six fingers' breadths below the pharynx there was a completely circular valve, with an opening about one centimetre in diameter. This valve seemed formed by a folding inward transversely of the mucous membrane, involving the whole circumference of the tube, the free edge of the valve being strengthened by firm tendinous fibres running round it.

Of congenital pouch there is perhaps one example, viz., that of Blasius,[9] but the case is not given in sufficient detail to show whether the malformation was congenital or acquired.

Of longitudinal division of the œsophagus there also exists one example, related by the same author.[10]

Etiology.—The essential cause of congenital malformation of the œsophagus is involved in the same obscurity that hangs over the whole subject of teratology. It is obvious, however, that the deformity must arise from some abnormal conditions, either in the spermatozoon, in the ovum before impregnation, or in the embryo. That the first cause is sufficient to produce malformation is proved by the fact that the same male occasionally produces a similar deformity in the offspring of different women.[11] With reference to the second cause, it is well known that unimpregnated ova are not unfrequently diseased, and it is possible that such ova, if fertilized, would in some cases produce a malformed fœtus. At the same time, so far as I am aware, no observations have been made in connection with the female element in reproduction analogous to that mentioned above in referring to the male element—that is to say, there is no instance on record in which the same female has by different males given birth to infants with a similar deformity. It is probable, however, that it is the third cause which is the most potent, and that by far the larger number of malformations of the œsophagus are due to disease of an embryo previously well formed, or to a displacement of formative material at a very early period of embryonic life; the main argument in support of this view being that even in cases where the gullet is partly absent, there are almost always traces of the obliterated portion. The most generally accepted view as to the immediate cause of œsophageal malformations is that they depend on "arrested development."[12] This view is probably

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[1] Loc. cit. [2] Op. cit. [3] Specimen No. 51.

[4] Philadelphia Med. Times, 1873, p. 705. [5] Bulletin de la Soc. Anat., 1873.

[6] Memorie dell'Academia delle Scienze di Torino, 1826, vol. xxx., serie 1a, pp. 155–170. [7] Fourcroy: La Méd. éclairée par les Sciences Phys., t. i., p. 301.

[8] Bolletino delle Scienze Mediche, t. xix., p. 267, 1851.

[9] Loc. cit. Many cases of œsophageal pouch have been recorded, but as far as I am aware, in every instance the subject has been an adult.

[10] Ibid., Fig. 2.

[11] Meckel: Handbuch d pathol. Anatomie, Leipzig, 1812, vol. i.

[12] Meckel: Loc. cit. Bischoff: Beiträge zur Lehre von den Eyhüllen des Menschlichen Fötus. Bonn, 1834.

correct so far as it goes, but it does not explain the *cause* of the arrested development. Schöller [1] considers that if the deformity were entirely due to imperfect evolution it would be more frequently met with, and Luschka [2] suggests that both influences, viz., disease and irregular development, are at work, and that in those cases in which the œsophagus and trachea intercommunicate, the sequence of events is somewhat as follows: First, the canal of the œsophagus becomes obstructed, then hypertrophy of the portion of it above the point of obliteration takes place, and the formative matter, being exhausted by the excessive development of the pouch, is not sufficient to close up the opening between the two canals. Hirschsprung [3] considers that the entire absence of anything in the least degree resembling a cicatrix refutes the idea of destructive ulceration, but it is probable that the effects of inflammation and ulceration occurring in the earliest period of fœtal life would be entirely obliterated at the time of birth. The frequent coexistence of other deformities with malformation of the œsophagus has been regarded as evidence that the latter depends on imperfect evolution, and not on disease. This is merely begging the question: the facts sustain equally well the theory that in such cases the embryo is extensively diseased.

If a glance be taken at the normal development of the œsophagus and trachea, as recently described by Kölliker,[4] it will facilitate the comprehension of the mode in which the malformation may arise through some slight morbid deflection of the normal process.

The whole intestinal canal, from the mouth to the anus, is formed of three segments, *i.e.*, a middle portion and two extremities. The former is called "the primitive intestine," the latter are the "cephalic" and the "pelvic" portions.

The primitive intestine is formed in mammals by the separation of the hypoblast and a layer of the mesoblast from the germinal vesicle. At first it consists of a groove or "semi-canal," but soon becomes transformed into a complete tube. Like the whole intestinal canal, this primitive intestine is also divided into three portions, an anterior, middle, and posterior. It is from the anterior portion that the pharynx, œsophagus, larynx, trachea, and lungs are developed. The opening of the primitive lung into the anterior portion of the primitive intestine is situated in mammals at the junction of the pharynx and œsophagus. In rabbits, on the tenth day, the anterior portion becomes differentiated into a ventral and a dorsal division. The ventral part is the germ for the lungs, larynx, and trachea, while the dorsal portion is the nucleus of the pharynx and œsophagus. The lower part of the ventral division becomes expanded to form the lung, which at that time consists of a semi-canal terminating in two vertical grooves, and freely communicating on its dorsal side with the œsophagus by means of a linear fissure somewhat wider at its lower end. A separation of the two organs takes place on the eleventh day, the anterior portion of the primitive intestine being thus differentiated into an anterior or tracheal segment, and a posterior or œsophageal segment. The separation proceeds from behind forward up to the level of the laryngeal orifice in the pharynx, and gradually becomes more and more complete. Above the laryngeal aperture no demarcation takes place between the air-passages and the digestive canals. The process just described occurs in the human fœtus in exactly the same manner. Kölliker saw an embryo of four weeks in which the two tubes were almost completely separated, only a thin membrane intervening between them. The sac-shaped lungs constituted at that time a prominence at the lower end of the œsophagus, covering it on each side like a saddle. Whether at that time a fissure-like communication still existed between the tracheal and œsophageal tubes is not clear from Kölliker's description. In any case, however, it is probable that, by the beginning of the second month, the entire separation of the two tubes is an accomplished fact.

The cephalic portion of the intestine originates from the epiblast. It grows backward to meet the pharyngeal extremity of the anterior part of the primitive in-

[1] Loc. cit. [2] Loc. cit. [3] Op. cit.
[4] Entwickelungsgeschichte des Menschen, Leipzig, 1879, p. 810, etc.

testine, until they are separated only by a thin membrane (the pharyngeal membrane of Remak).[1] The membrane then disappears, and its residue forms the arcus palati and uvula.

Symptoms.—The phenomena of congenital malformation of the œsophagus are so characteristic, that when present they will at once be recognized. The infant may appear healthy while at rest, but the moment it attempts to swallow the most distressing attacks of suffocation supervene, and there is great danger of one of these proving fatal. In Porro's case, actual suffocation appears to have taken place through a large quantity of milk passing into the air-passages, but as a rule the infant becomes gradually weaker, and expires at the end of a few days from exhaustion. When the malformation affects the upper portion of the tube, it can sometimes be felt on passing the finger down the pharynx of the infant. At other times, the use of a bougie will reveal the condition of the canal, the instrument being arrested at the end of the œsophageal pouch. Although in most cases no instrument reaches the stomach, meconium is often passed.

Pathology.—The appearances after death vary according to the nature of the deformity. Where the œsophagus is absent, the pharynx ends in a cul-de-sac, and the stomach is generally adherent to the diaphragm. Of the five instances of this kind one was an anencephalous monster; in another the pharynx, larynx, and trachea were wanting; and in two the condition of the other organs is not stated. In cases of blind termination the gullet may terminate quite high up, as in Roederer's case, or may reach nearly to the stomach, as in that of Warner. In the records of this class of cases, the other organs—especially the intestinal canal—generally show a wide departure from the normal form: thus, in one instance[2] the stomach was deficient, the intestinal canal consisting of two parts, one comprising the colon and rectum, the other the small intestine; the latter terminated at both ends in a blind sac, and the upper portion of the larger bowel was closed in a similar manner. In another case[3] the intestinal canal was divided into four parts, each terminating at both ends in a blind extremity, while the anus was imperforate. In a third example[4] the fundus of the stomach was wanting, but in its place was a wide round opening, the edges of which were formed of muscular tissue. In a fourth instance[5] the brain was imperfectly developed, and the upper part of the œsophagus communicated through the vertebral canal with the mouth. In a fifth case the subject was an anencephalous monster.[6] In other examples of this variety of malformation the condition of the other viscera is not stated. The cases, however, in which there is deficiency of a greater or less amount of the middle third of the œsophagus, with inosculation between it and the air-passages, are the most common, and the most interesting to the pathologist. Here the upper part of the gullet usually terminates in a dilated pouch about half an inch above the bifurcation of

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[1] In the two cases of "obliteration" of the œsophagus referred to, and probably in some of the examples of "blind termination," the malformation was probably due to non-obliteration of this normal embryonic membrane, and it might have been expected that obstruction of the *pharynx* itself would sometimes result from the same arrest of development. I am not aware, however, of the existence of any case supporting this view. It may be added that common as are pouches of the pharynx there do not appear to be any proved examples of congenital deformity on record.

[2] Roederer: Loc. cit.

[3] Marrigues: Loc. cit.

[4] Pagenstecher: Loc. cit.

[5] Lallemand: Loc. cit.

[6] Pinard's second case: Loc. cit.

the trachea, while the lower portion generally originates from the windpipe still closer to the bifurcation, and passing downward enters the stomach in the ordinary way. The portion of the œsophagus immediately at its origin from the trachea is generally very narrow, but as it descends it acquires its normal size. The upper portion, or pouch, is always much dilated and its walls considerably thickened. Sometimes the pouch-like expansion is limited to the gullet (as in my case), while in others (as in those of Ilott) the enlargement involves the pharynx also. The two separate portions are generally connected by a small band of muscular or tendinous fibres. In my own case (see Fig. 22 B) the lower extremity of the pouch (*a'*) actually overlapped the lower segment of the œsophagus (*b'*) where it proceeded from the trachea. On laying open the gullet, the lining membrane is almost invariably seen to be perfectly free from disease. In only one [1] out of all the recorded cases is there any mention of ulceration of the mucous membrane, and in that instance the lesion was superficial, and was no doubt caused by the retching and straining which occurred on attempting deglutition. On dividing the trachea, the opening of the œsophagus may generally be seen as a small aperture situated in its posterior wall and directed downward. Sometimes the opening is described as oval and sometimes as round in shape, but in my specimen (Fig. 22 C *b''*) the aperture is distinctly crescentic—the concavity being directed downward. In this specimen (Fig. 22 C *a''*) the hypertrophied pouch of the œsophagus forms a projection on the posterior wall of the trachea, which considerably diminishes its lumen. In one of Hirschsprung's cases [2] more or less complete *cartilaginous rings* were found at the *lower end of the œsophagus.*

As regards the associated deformities, in one instance [3] there were spina bifida, absence of anus, and a single horseshoe kidney placed over the spine. In two cases there was trifurcation of the trachea,[4] and in two others there was atelectasis pulmonum.[5] In another case the stomach and intestines were contracted.[6] The other deformities associated in different cases with œsophageal inosculation were: malformation of the uterus;[7] combination of the male and female genital organs;[8] imperforate anus with a communication between the intestine and bladder and deformity of the pelvis;[9] absence of right lung and atresia ani;[10] imperforate anus with intercommunication between bladder and rectum, deficiency of the radius in each arm, and clubbed hands;[11] imperforate anus with intercommunication between rectum and urethra and right auriculo-ventricular opening almost blocked up by membranous diaphragm.[12]

In only three instances is it expressly stated that there was no other deformity; while in nineteen cases there is either no mention of the condition of the other organs, or it is formally stated they were not examined.

Diagnosis.—There is no disease for which this malformation can be mistaken. The absolute inability to swallow, which cannot fail to be observed from the first time the infant attempts to suck, is characteristic; while, if a measured quantity of milk be administered with a teaspoon, and the ejected fluid collected, it will be found that it is all returned. The diagnosis can be further verified by the passage of a catheter. In

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[1] Schöller: Loc. cit.
[2] Op. cit., case 7, p. 35.
[3] Davis: Loc. cit.
[4] Hirschsprung: Loc. cit.
[5] Ibid.
[6] Padieu: Loc. cit.
[7] Spec. 457, Boston Museum.
[8] Levy: Loc. cit.
[9] Hirschsprung: Op. cit.
[10] Maschka: Loc. cit.
[11] Pinard's first case: Loc. cit.
[12] Polaillon: Loc. cit.

new-born children the minimum diameter of the œsophagus is 4 mm., while the distance from the border of the gums anteriorly to the cardiac orifice of the stomach is 17 ctm.[1] If, therefore, a catheter of suitable size cannot be passed for this distance, it may be presumed that there is a congenital obstruction.

Prognosis.—As already stated, infants born with a malformation of the œsophagus generally succumb in a few days, the duration of life probably depending more upon the vigor of the child when born than on the exact nature of the malformation. Thus, in 5 cases of complete deficiency of the œsophagus, 1 infant lived 7 days, another 8 days, a third "a few days," while in the 2 others no information is given on this point, though, from the context, it is possible that the infants were both born dead. In 8 cases of blind termination, 3 infants lived to the third, fourth, and fifth day respectively, while in 5 cases the duration of life is not stated. In 37 cases, in which there was inosculation between the œsophagus and air-passages, the duration of life was as follows:

Date of death.	Cases.
Two hours after birth	1
Second day	8
Third day	4
Fourth day	6
Fifth day	4
Sixth day	1
Seventh day	1
Ninth day	1
Eleventh day	2
Twelfth day	1
A few days	1
Not stated	7

In one of the cases in which the gullet and trachea intercommunicated, while the former was otherwise normal, the patient lived seven weeks. The cause of this comparatively long existence will be understood from the following description:

"In the median line, nearly half an inch below the lower border of the cricoid cartilage, was a fistulous communication between the two tubes, having a longitudinal diameter of three lines, and a transverse diameter of one line. The direction of the fistula was downward and backward, the opening in the œsophagus being at a lower level than in the trachea; the edges were smooth and rounded, and the mucous membrane normal. The danger of passage of the contents of the œsophagus into the trachea appears to have been guarded against to some extent by the close opposition of the walls of the fistula."[2]

In one of the two cases of membranous obstruction of the œsophagus, the patient lived till the third day; in the other the duration of life is not stated.

Treatment.—In none of the recorded instances was any attempt made to preserve the life of the infant by any surgical procedure, and it is obvious that but little hope can be entertained of relief by art, as the opening into the air-passages, which is so often present, would probably interfere

[1] Mouton: Du Calibre de l'Œsophage, Paris, 1874, p. 61. [2] Lamb: Loc. cit.

with the maintenance of life even if the œsophageal canal were patent throughout. Mr. Holmes[1] thinks that where no tracheal communication can be made out an operation might be attempted. "The object," he observes, "would be to cut down upon the point of a catheter passed down to the pharynx, and then to attempt to trace the obliterated œsophagus down the front of the spine, until its lower dilated portion is found. A gum catheter would then be passed through an opening made in the upper portion, and so into the stomach through the lower portion. If the two portions are near enough to be connected by silver sutures over the catheter, and if the latter can be retained until they have united permanently, success might possibly be maintained." Such an operation would evidently be extremely hazardous and difficult, if not impracticable. Gastrostomy has been recommended by Sédillot, who remarks: "In all cases where the œsophagus is simply obliterated, atrophied, or interrupted, gastrostomy would give the hope of saving the infant, without any accident except that of the operation itself. If there exists a communication between the lower end of the œsophagus and the trachea, there is a risk that food received into the stomach would be regurgitated into the air-passages; but the narrowing of the abnormal opening, and its natural tendency to close, would afford some security against such an inconvenience." While quoting the views of this eminent surgeon, I cannot endorse them, as I consider that section of the stomach and the subsequent artificial alimentation of a newly-born infant could not be attended with satisfactory results. The following case illustrates the malformation:

In September, 1879, I was consulted (on the advice of Dr. Walker, of Putney) by the father of a male infant, eight days old. The history of the case, as supplied to me by Dr. Walker, was as follows:

Mrs. S., a primipara, gave birth to a male infant in September, 1879. At birth the child was feeble and badly nourished, and had difficulty both in breathing and crying; there was also a constant rattling noise in the throat, which continued in spite of all efforts to remove the mucus. On the following day milk and water was given, but it was at once rejected through the mouth and nostrils; later in the day the breathing became more troubled. Dr. Walker administered a measured quantity of milk and water, and having taken steps to receive all that was ejected from the mouth and nose, found that nearly all the ingesta were returned. Next day the child was able to keep down a very small quantity of milk, but he had become extremely emaciated, and appeared to be sinking. Enemata of milk and lime-water were given, and a small quantity of brandy and water was occasionally administered by the mouth. On the fourth day Dr. Fenn, of Richmond, saw the child with Dr. Walker, and on passing a gum-elastic catheter down the pharynx, they found its course completely arrested about two inches below the cricoid cartilage. During the next few days the child seemed to improve, the breathing became easier, and crying and coughing much stronger. Drs. Walker and Fenn having arrived at the conclusion that the case was one of obstruction of the œsophagus, consulted me as to whether I was prepared to perform any operation with a view of overcoming the difficulty. I did not, however, feel myself justified in recommending any operative procedure, and the child died from exhaustion on the eleventh day after birth.

The father of the infant stated that a former wife had given birth to a child which died after nineteen days with exactly the same symptoms as those recorded in this instance. No other child of his had any malformation.

A post-mortem examination, limited to the throat, was made by Dr. Walker and Mr. Hovell, with the following results: The infant was of ordinary size and well formed, but much emaciated. There was no malformation of the lips or palate. The pharynx was of normal configuration, but slightly constricted at its junction with the œsophagus, which consisted of two portions—an upper part, which communicated with the pharynx, and a lower portion, which, originating from the stomach, passed upward and terminated in the trachea.

[1] The Surgical Treatment of the Diseases of Infancy. London, 1869, second edition.

The upper portion of the œsophagus terminated in a blind extremity 2½ ctm. below its origin. The whole of this portion of the gullet hypertrophied, so that it measured 3 ctm. in circumference.[1]

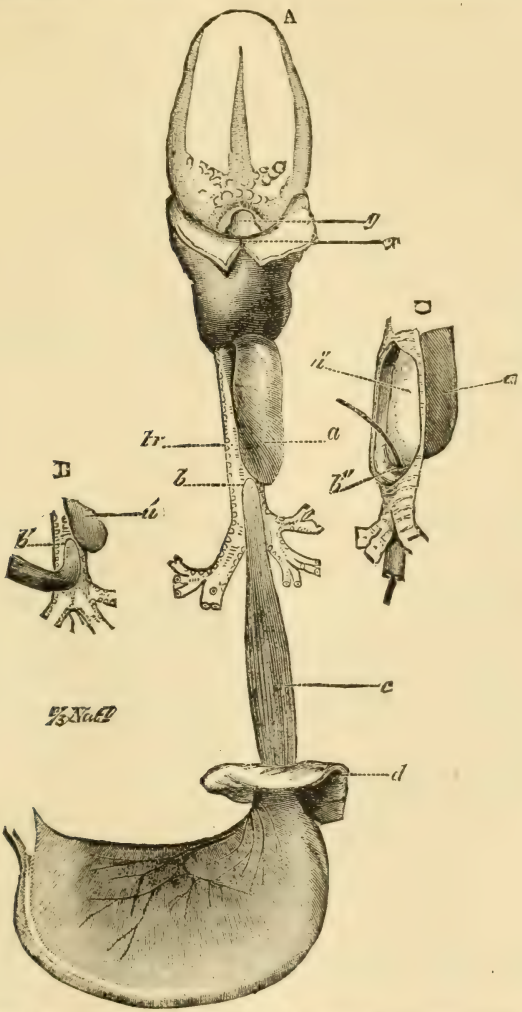

FIG. 22.—Congenital Malformation of the Œsophagus. A, the tongue, pharynx, trachea, imperfect œsophagus, and stomach. *a*, the upper portion of the œsophagus; *b*, the determination of the lower portion of the œsophagus in the trachea; *c*, the lower fourth of the œsophagus which is seen to be well developed; *d*, a small remnant of the diaphragm; *tr*, the trachea; *x*, the upper part of the pharynx, cut in the middle and turned down; *y*, the epiglottis. B, fragmentary illustration showing the posterior surface of the trachea and the two terminations of the œsophagus, where the abnormality exists. The upper extremity of the lower portion of the œsophagus, *b'*, is thrown on one side, in order to show that it has no connection with the trachea, except just at the point where intercommunication takes place; the relation of the lower extremity, *a'*, of the upper portion of the œsophagus is also distinctly shown. C, the lower portion of the trachea divided in front by a vertical incision, with its two sides widely separated. *a* is the œsophageal pouch; *a''* shows the indentation in the posterior wall of the trachea caused by the pouch; *b''* is the opening between the trachea and the upper extremity of the lower portion of the œsophagus; a piece of twine is seen passing from the trachea into the œsophagus, which has been (diagrammatically) divided in order to show the passage of the twine.

Ascending from the stomach, the lower end of the œsophagus passed upward in the usual manner, but 3½ ctm. above the diaphragm its muscular fibres suddenly

[1] The ordinary circumference of the œsophagus at birth is from one and a half to two centimetres, but it seldom exceeds 18 mm.

became thinner and paler, and the tube becoming smaller, terminated in the trachea immediately beneath the lower end of the upper division of the gullet. The connection between the two parts of the œsophagus was maintained by a narrow muscular fasciculus, which passed from the upper extremity of the inferior portion to the under surface of the upper part, and by a thin membranous expansion, which intervened between the two portions. On dividing the trachea vertically in front, the lower part of the upper portion of the œsophagus was seen to form a distinct projection on the posterior wall of the trachea, considerably diminishing the antero-posterior diameter of the latter tube. Situated transversely on the posterior wall of the trachea, at a point just below the level of the lower end of the upper section of the œsophagus, was a minute crescentic opening, directed downward and backward, which led into the lower portion of the œsophagus. The rectum was normal.

Congenital Dilatations and Stenoses.—As, in consequence of symptoms not manifesting themselves till later in life, it is often impossible to determine whether certain dilatations or stenoses are congenital or acquired, it has been thought better to treat those conditions as diseases rather than malformations. The dilatations which probably depend on some congenital weakness have been considered at page 80, and stenosis of probably congenital origin at page 108.

POST-MORTEM SOFTENING OF THE GULLET.

Just as softening, and even perforation, of the stomach sometimes occurs as a result of the action of the gastric juice, so likewise a similar process occasionally takes place in the gullet after death. This is much more rare, however, in the œsophagus than in the stomach, as the former is but seldom exposed to the action of the solvent. It has long been a moot question whether the softening takes place during the last hours of life or only after death; and in spite of the patient consideration which has been given to this point by Budd,[1] Banton,[2] Ziemssen,[3] and others, the problem is not yet absolutely decided.

The chief factors in post-mortem solution of the gullet are, first, the presence within its channel for a considerable time of gastric juice which retains its normal acidity; secondly, a proper degree of temperature (90° to 100° Fahr.); thirdly, the absence of resistance in the tissues themselves to the digestive power of the fluid—a resistance attributed by Hunter to the influence of the "vital principle," and by modern authorities, with some probability, to the neutralization of the acid of the gastric juice by the presence in the living tissues of a large quantity of alkaline blood. In the majority of cases where softening of the gullet has been observed the stomach has also been more or less destroyed. Post-mortem solution is much more common in the bodies of young children than in the case of adults, but I am not aware that any explanation of this fact has been offered. The degree of maceration of the tissues varies from mere erosion of the epithelial layer, either in small patches or in longitudinal strips corresponding to the folds of the lining membrane of the tube, to complete perforation of the entire thickness of the gullet wall over a greater or lesser area. Intermediate stages of the process have been noted where, in

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[1] Croonian Lect., London Med. Gazette, 1847, vol. xxxix., p. 896 et seq.
[2] Lancet, October, 1859.
[3] Cyclopædia of the Practice of Medicine, vol. viii., p. 89 et seq.

addition to the stripping off of the epithelium, the denuded mucous membrane had a whitish sodden look, as if it had been steeped in spirit. All these degrees of digestive solution may sometimes be observed in the same specimen. When perforation has taken place the œsophageal wall may present one or more irregular rents, or it may be fissured in a longitudinal direction; the edges of the apertures in either case being ragged, and fringed with flocculent shreds of half-dissolved tissue. In some instances the œsophagus is destroyed throughout its whole circumference, but usually the digestive action is confined to the posterior wall. The reason of this is no doubt to be found in the fact that the body has been lying in the supine position. In no recorded case, so far as I am aware, has the action been seen to have extended above the lower half of the gullet. The wall of the œsophagus in the neighborhood of the softened parts is generally quite normal in appearance, but the vessels of the contiguous mucous membrane are sometimes congested, and even patches of ecchymosis have been observed. In two cases reported by Hoffmann[1] the mucous membrane of the gullet was saturated with extravasated blood.

Where the wall of the gullet has been eaten through, the solvent action of the gastric juice is found to have extended to the neighboring parts. One or both pleural cavities are seen to have been laid open by the destruction of the portion of the parietal layer of the membrane lying nearest to the point of perforation in the œsophagus; and gastric juice with shreds of undigested food, mixed, in some instances, with blood-stained fluid from maceration of the adjacent lower lobe of the lung, may be found in the thorax. There is generally, moreover, some emphysematous distention of the areolar tissue in the posterior mediastinum. It will not unfrequently be found that only one pleural cavity has been opened, and in such cases it is almost invariably the left that communicates with the hole in the gullet.[2] The cause of this will be apparent, when it is remembered that the lower end of the œsophagus lies to the left of the vertebral column, and therefore in closer proximity to the left pleural sac than to its fellow.

It is probable that similar changes may take place in the gullet when life is at its lowest ebb, especially when the approach of death is very slow and gradual, as in persons enfeebled by long wasting maladies. In such cases the conditions already described as necessary for the process of what may be called "self-digestion," come into play. Long continuance in the horizontal position and atony of the muscular walls of the gullet are likely to favor regurgitation of the acid contents of the stomach beyond the cardiac orifice, while the feeble circulation of impoverished blood leaves the tissues exposed to the digestive power of the gastric juice. Although this theory is very plausible, no positive proof of its soundness can be given; nor is this a matter of any practical importance, for the recognition of digestive solution of the œsophagus, when the patient is *in articulo mortis*, can lead to no result.

From statistics given by Ziemssen,[3] there seems to be some connection between softening of the gullet and certain diseases of the brain. He affirms that in 2,587 autopsies made at the Pathological Institute at Erlangen, from 1862 to 1876, softening and perforation of the gullet were found in 9 cases. In 1 of these the head was not examined, but in

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[1] Virchow's Archiv, Bd. xliv., p. 352. Ibid., Bd. xlvi., p. 124

[2] A case, however, has lately been reported by Quincke (Deutsches Archiv für klin. Med., 1879, vol. xxiv., p. 72), in which the right pleural sac alone was perforated.

[3] Op. cit, p. 104.

each one of the other 8 cases there was (in addition to pathological changes elsewhere) some lesion of the brain. In 4 of them there was inflammation of the membranes at the base of the brain, together with acute hydrocephalus; in 1 there was an enormous congenital hydrocephalus; in 1 there was a cicatrix in the striate body, with slight chronic hydrocephalus; in 1 great congestion of the brain, with slight hydrocephalus, and in 1 moderate congestion, together with some œdema of the brain. The ages of these patients ranged from three months to fifty-eight years. Whether wider observation would confirm these statistics it is of course impossible to say, but the simultaneous presence of pressure on the cerebral substance and digestive solution of the gullet in *all* the cases examined, certainly seems to suggest a relation of cause and effect between the two conditions.

SECTION V.—THE NOSE.

ANATOMY OF THE NASAL FOSSÆ.

THESE intricate cavities are bounded *above* by the under surface of the anterior third of the base of the skull, *below* by the upper surface of the hard palate, *externally* by the wall of the orbit and by the superior maxillary bone, while *internally* the two nasal chambers are separated from each other by a perpendicular septum, in part bony and in part cartilaginous. In front the nasal fossæ open into the cavities of the nostrils or *vestibula nasi* (hereafter described, p. 169) by two oval apertures—the anterior nares—placed in the vertical plane, and inclined very nearly at right angles to the external orifices of the nostrils. Posteriorly they communicate with the upper part of the pharynx by the posterior nares or *choanæ*, two quadrilateral openings looking backward and somewhat downward. Each nasal cavity may be described as an irregular four-sided passage, of somewhat pyramidal form. Of this passage the upper wall or roof is horizontal in its middle third, but inclines abruptly downward both in front and behind; the lower wall or floor is almost horizontal, having only a slight inclination downward and backward, while the external and internal walls are, roughly speaking, vertical and parallel to each other.

The roof is formed, in its horizontal portion, by the cribriform plate of the ethmoid bone, and constitutes, for a limited space, the immediate floor of the brain. In its anterior portion it is made up of the nasal process of the frontal and the nasal bone proper, its downward inclination gradually increasing from behind forward. The posterior third of the roof, which is inclined almost at right angles to the horizontal portion, is formed by the body of the sphenoid bone, being continuous behind with the basilar process of the occipital.

The floor of each nasal cavity is composed anteriorly of the palatine process of the superior maxilla, and posteriorly of the horizontal plate of the palate bone. It is slightly hollowed out from side to side, and presents anteriorly the orifice of the nasal canal.

The internal or median wall, constituting the *septum narium*, is roughly quadrilateral in outline, and after the seventh year is generally inclined to one side or the other, thus slightly enlarging one cavity at the expense of its neighbor. In many cases, however, this lateral deflection of the nasal partition is sufficiently pronounced to cause serious obstruction in one of the nasal passages, a deformity which will be subsequently considered under the head of Deviations of the Septum.

The septum of the nose is formed behind by the vomer and perpendicular plate of the ethmoid, and in front by a vertical cartilaginous plate received into the angle of junction between these bones. The inner edge of the palatal process of the superior maxillary bone and of the palate bone itself rises on the upper aspect into a crest which forms a slight bony ridge along the middle line of the floor of the nose when the bones of both sides are in apposition. This ridge is the base of the nasal septum.

The external wall of each cavity is placed almost vertically, but with a slight inclination downward and outward. In its upper part it is formed by the frontal process of the superior maxilla, the lachrymal bone, and the orbital plate of the ethmoid; in its lower part by the inner surface of the body of the superior maxilla, the perpendicular plate of the palate bone, and the internal pterygoid plate of the sphenoid. The surface of the outer wall is, however, rendered uneven by the turbinated bones which form projections in the nasal cavity, leaving intervening spaces between them which are called meatuses.

There are always three turbinated bones, and frequently a fourth. Each one is formed of a thin lamina, somewhat triangular in shape, perforated by numberless minute openings, and so curved upon itself as to present a convexity upward, inward, and slightly forward. The three turbinated bones spring from the lateral walls of

the nasal cavity, at about equal distances from each other, their margins of attachment being horizontal and nearly parallel, while their free incurved margins are convex, so that each bone is widest at its centre. The posterior extremities of their attachments are placed nearly in the same vertical line, and as each bone is longer than the one above it the anterior extremity of the inferior bone approaches nearer to the anterior nares than that of the middle bone, and this, again, is very considerably in advance of the anterior extremity of the upper bone. Examining the turbinated or spongy bones more in detail, it will be seen that the inferior one is the most developed and the most compact in structure, and that it is the only one which is an independent bone. It varies in length from twenty-five to fifty millimetres, and in breadth from five to fifteen. It articulates with the superior maxilla, its anterior pointed extremity coming into relation with the anterior portion of the nasal process of that bone, while its posterior rounded extremity extends to the internal pterygoid process. The middle and superior bones are merely processes of the ethmoid, and though separated behind they are united together in front. The middle spongy bone is more rolled round at its centre than at its extremities. Near its anterior free end a small projection—the *agger nasi*[1]—is directed inward, and on the corresponding level of the septum there is a slight bulge. These two minute protuberances make a faint line of demarcation between the olfactory region above and the respiratory passage below. Above the middle spongy bone is the superior one, and this, again, by a horizontal slit in its posterior edge, is often divided, so that there is, in fact, a fourth turbinated bone, which is still shorter than the one below it. The existence of the fourth bone was first pointed out by Santorini,[2] and, according to Zuckerkandl,[3] it is present in more than one-third of all cases.

By the projection of the turbinated bones each nasal cavity is broken up into three passages or meatuses, communicating internally with that remaining narrow portion of the fossa where nothing is interposed between the roof and the floor. The uppermost of these passages, the superior meatus, is limited by the upper and middle turbinated bones and by that portion of the external wall included between them; it communicates by means of a foramen with the posterior ethmoidal cells, and through them with the sinuses in the body of the sphenoid. When there is a fourth spongy bone there is also a fourth meatus. The middle meatus is situated between the middle and inferior turbinated bones. It communicates above with the anterior ethmoidal cells, and on its outer wall is a crescentic opening—the *hiatus semilunaris*, or ethmoidal fissure—about two centimetres in length, the convexity of the crescent being directed forward and downward. The curve of the unciform process of the ethmoid bone forms the lower boundary of the hiatus semilunaris, the upper edge being constituted by the lower surface of the ethmoidal cells. One of the ethmoidal cells bulges outward opposite the middle of the unciform process, giving rise to a prominence which has been called by Zuckerkandl[4] the *bulla ethmoidalis*. The hiatus semilunaris leads to a funnel-shaped cavity—the infundibulum—which communicates at its upper and anterior part with the frontal cells, and at its lower and posterior part by the *ostium maxillare* with the antrum of Highmore. Immediately behind the hiatus semilunaris there is also often a small additional opening into the antrum[5]—the *ostium maxillare accessorium*. The inferior meatus runs between the lower turbinated bone and the floor of the nasal cavity. In the anterior part of the meatus, at the articulation of the turbinated bone with the nasal process of the superior maxilla, is situated the orifice of the lachrymal duct.

Each nasal fossa is, as already remarked, continuous in front with the cavities of the nostril, or *vestibula nasi*. Here, however, the bony framework gives place to cartilaginous plates. These, though subject to variations in form and number, consist, in their simplest development, of three distinct cartilages, one median and two lateral. The former, by means of its rhomboidal perpendicular plate, helps to complete the septum narium, and supports the bridge of the nose below the nasal bones. The portion of its anterior border which serves the latter purpose is broad and grooved, while the part above it is applied to the suture between the nasal bones, and that below it is bent abruptly backward to terminate at the anterior nasal spine. Attached at an acute angle to the broad and grooved portion are two lateral plates which, together with the lateral cartilages proper, serve to support the outer walls of the cavities of the nostrils. Each of these lateral plates is triangular in form, and is

[1] H. Meyer: Lehrb. d. phys. Anat. Leipzig, 1856.
[2] Observ. Anatom., Venetiis. 1724, cap. v., p. 89.
[3] Anatomie der Nasenhöle, Wien, 1882, p. 31. [4] Op. cit., p. 36.
[5] According to Zuckerkandl (op. cit., p. 22) this accessory foramen was found in every ninth or tenth cranium which he examined.

attached above to the sharp margin of the nasal bone, while its lower margin is free and somewhat incurved, so as to make a slight projection inside the nostril. The lateral cartilages proper support the outer and a small part of the inner walls of the nostrils. They consist of two segments united together at an acute angle. The larger portions, roughly triangular in shape, slightly overlap the lateral plates of the median cartilage and form the framework of the *alæ nasi*. The smaller portions give support to the septum between the nostrils, filling up the space left by the retreating border of the perpendicular plate.

The interior of the nasal cavities is lined throughout by mucous membrane, which is continuous in front with the skin of the face and posteriorly with the mucous lining of the pharynx. It varies considerably in character in different parts, but in its general arrangement it follows pretty closely the ramifications of the bony framework. It consists of two layers, a deep fibrous, and a superficial mucous stratum which is covered by epithelium. The deep layer forms the immediate covering of the skeleton of the nose, having the functions of periosteum over the bones, and of perichondrium over the cartilaginous parts. It is somewhat loosely attached to the cartilages, but in other parts is firmly adherent. This membrane has been shown by Panas[1] to be much thicker and more fibrous at the upper and posterior part of the septum and the immediately adjoining space on the base of the skull than at any other part. The superficial layer of the mucous membrane may be roughly divided, according to its histological character and physiological functions, into two portions—a superior, or olfactory, and an inferior, or respiratory, tract. In the former the membrane is thin and closely adherent to its deep layer or periosteum ; it is not very vascular, but is of a palish brown color from the presence of pigment in the epithelium and the glands. The epithelium is of the columnar variety, but without cilia, and lying among the columnæ are the peculiar rod-shaped bodies known as the *olfactorial cells* of Schulze. The blood-supply of the olfactory region comes principally from the anterior ethmoidal and the nasal branches of the posterior ethmoidal arteries, while the nerves are the terminal twigs of the olfactory itself, which, after passing through the aperture in the cribriform plate of the ethmoid, is distributed to the roof and to the inner and outer wall of the nasal cavity in the upper third. In the respiratory tract the deep is separated from the superficial layer of the mucous membrane by some connective tissue which gives support to the numerous vessels and capillaries supplied to this part. Anteriorly the latter approximates in character to the external skin, its epithelium being tessellated and disposed in layers, while just within the nostrils it is provided with hair-sacs and sebaceous follicles. The tessellated epithelium not only covers the whole of the mucous membrane which has a cartilaginous framework, but extends as far back as the anterior extremity of the lower turbinated bone. The remainder of the respiratory tract is furnished with columnar ciliated epithelium, the cilia of which vibrate toward the posterior nares. The nervous supply of this portion of the nasal passage is mainly derived from offshoots of Meckel's ganglion. In the neighborhood of the foramina, by means of which the nasal cavities communicate with the adjacent sinuses, the mucous membrane does not exactly follow the contour of the bony framework, but presents folds, which deserve a brief mention. Thus, in front of the chink-like opening by which the anterior ethmoidal cells open into the middle meatus, the mucous membrane is raised into a fold to form a groove, which corresponds to the fissure in the bony skeleton, already described as the hiatus semilunaris, and considerably increases the depth of that cavity. The mucous membrane of the antrum is also occasionally continuous with that of the middle meatus by means of a small circular accessory opening placed just above the attachment of the inferior turbinated bone, near the posterior extremity of the hiatus semilunaris. In the inferior meatus the shape of the outlet of the lachrymal duct is considerably modified by the disposition of the mucous membrane around it. In the recent state this orifice is sometimes circular in form and sometimes elongated, either in a vertical or transverse direction, while the mucous membrane is occasionally arranged so as to make a groove below the opening. On the floor of the nasal cavities the mucous membrane dips down into the naso-palatine foramina, which are situated one on each side of the septum at about half an inch from the anterior nares, being sometimes continuous through these openings with the mucous covering of the hard palate.

The mucous membrane covering the turbinated bones is crowded with glands, the openings of which may be readily seen upon its surface, though the glands themselves are deeply imbedded in the sub-epithelial structures. On the other hand, the glands in the membrane covering the septum are small in size and few in number.

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[1] Bull. de la Soc. de Chir., July 9, 1873.

The arterial supply of the nasal fossæ is derived from two sources, viz., the posterior nasal branch of the internal maxillary, and the anterior ethmoidal branch of the ophthalmic. The former enters at the spheno-palatine foramen and divides into two branches: a lateral, passing off behind the turbinated bones and supplying the adjacent structures, and a median branch supplying the septum and forming an anastomosis with the septal branches of the anterior ethmoidal. The latter artery, besides supplying the anterior portion of the septum, also sends branches to the lateral portions of the fossæ. All the above arteries contribute to form a dense capillary network, which is most developed beneath the mucous lining of the respiratory tract. The veins of the nasal cavities, as a rule, accompany the arteries, but are larger and more numerous. They communicate chiefly with the facial and ophthalmic veins, but also pass through the cribriform plate of the ethmoid, and in young subjects send branches through the foramen cœcum, the superior longitudinal sinus, a few twigs not unfrequently, indeed, terminating in the coronary sinus. The veins over the turbinated bones, between the periosteum and the mucous membrane, were first shown by Kohlrausch [1] to form a "cavernous network," and soon afterward a more detailed description of this structure, with highly artistic illustrations, was given by Bigelow,[2] who demonstrated the truly erectile character of the structure. Voltolini [3] pointed out that each turbinated bone, in spite of its extremely delicate structure, can, after maceration, be seen to be perforated by countless minute holes. Through these openings small vessels pass, and they perforate the bone in such abundance that in a space of three square millimetres ten patent vessels have been counted. The soft parts are closely adherent to the elevations and depressions of the periosteum, covering the bone, as Voltolini says, just as a sponge does the hard coral beneath it. The cavernous network, with its bony support and investing mucous membrane, constitutes the "turbinated bodies."

The lymphatics form a very superficial network, and terminate in two trunks which pass close to the openings of the Eustachian tubes to join glands in the lateral wall of the pharynx.

The nerves are of two kinds—those of general and those of special sensation. The former consists of the spheno-palatine branch of the second division of the fifth, and of the vidian nerve which supplies the upper and back part of the septum; of the nasal branch of the ophthalmic which ramifies on the upper and interior part of the septum and the upper portion of the external wall; of the naso-palatine nerve which supplies the middle part of the septum; and of the anterior palatine nerve which is distributed to the middle and inferior turbinated bodies. The nerve of special sense is the olfactory, the filaments of which, after passing through the foramina in the cribriform plate of the ethmoid, are distributed to the upper third of the septum, and to the superior and middle turbinated bodies. Some filaments of the sympathetic can also be traced in the nasal mucous membrane.

RHINOSCOPY.

The nose can be examined by three methods. Thus: First, a speculum may be passed into the nares, and a large portion of the anterior part of the nasal cavity thereby brought into view; secondly, the upper and central parts of the nose can be sometimes inspected by means of a small mirror introduced along the floor, with its reflecting surface directed obliquely upward; and thirdly, the hinder portion of the nose and the posterior nares themselves can be seen by placing a mirror at a suitable angle behind the uvula. Hence *anterior rhinoscopy, median rhinoscopy, and posterior rhinoscopy* may be practised.

[1] Müller's Archiv, 1853, p. 149.
[2] Boston Med. and Surg. Journ., April 29, 1875.
[3] Monatsschrift für Ohrenheilkunde, 1877, No. 44.

ANTERIOR RHINOSCOPY.

History.—From a very early period in the history of medicine, attempts were no doubt made to inspect the interior of the nasal fossæ by throwing back the patient's head, and tilting the tip of the nose upward with the finger. A nasal speculum was described and figured by Dionis[1] at the beginning of the last century; it was simply a dilating instrument, and was recommended by the inventor chiefly as part of the apparatus required for the removal of polypi. In modern times, Markusovzsky seems to have been the first to attempt a regular examination of the nasal cavity by means of a speculum, and in 1859, while on a visit to Pesth, I had an opportunity of seeing his instrument, which appeared to be a modification of Kramer's ear speculum. In 1860 Czermak[2] expressed his appreciation of it. Soon afterward Voltolini[3] stated that he was able to see the Eustachian cushion by passing an ear speculum into the nose. Subsequently he showed[4] that by dilating the nasal passages in a good light, the pharyngeal wall could be easily seen, and that this was particularly the case in ozæna, when there was atrophy of the turbinated bodies. In 1868 Thudichum[5] described a speculum for examining the anterior nares, while in the same year Duplay[6] devised an excellent instrument for the inspection, from the front, of the deeper parts of the nose; to this method he gave the name of *anterior rhinoscopy.* In 1872 Fränkel[7] published an account of his admirable speculum, hereafter described. In 1873 Michel[8] stated that he was often able, by means of Duplay's speculum, to see the posterior half of the Eustachian orifice, and the whole of its cushion, and that he could perceive the movements of the tube in phonation and swallowing.

A new departure was given to rhinoscopy, carried out from the front, by Zaufal,[9] who, in 1875, first recommended the use of a funnel-shaped speculum, long enough to pass completely through the nasal cavity. Notwithstanding that the merit of this method has been contested by Weber-Liel, Gruber, Schrötter, and Voltolini, it is undoubtedly of value, and Habermann,[10] a pupil of Zaufal's, has recorded a very large number of cases in which the funnel-speculum has been employed with much advantage.

Nasal Specula.—For ordinary examination of the front part of the cavities, Fränkel's speculum will be found most serviceable. This instrument consists, as may be seen in the annexed woodcut (Fig. 23), of two fenes-

Fig. 23.—Dr. Fränkel's Nasal Speculum.

trated blades, made of German silver wire, 2½ ctm. in length, and somewhat resembling miniature obstetric forceps, but with shanks about 5 ctm. in length. The proximal extremities of the shanks are connected by a horizontal bar, through which there is a central screw acting on both blades. Fränkel recommends that one blade of the instrument should be introduced into each nostril, but mentions that both blades may be passed

[1] Cours d'Opérations de Chirurgie, Paris, 1714, 2e éd., p. 483 and Fig. 37 E.
[2] Wien. med. Wochenschrift, 1860, No. 17.
[3] Die Rhinoscopie und Pharyngoscopie, Festschrift zur 50 jährigen Jubelfeier der Universität Breslau zum 3. August, 1860.
[4] Monatsschr. für Ohrenheilkunde, No. 3, 1868.
[5] Lancet. 1868, vol. ii., pp. 243, 244.
[6] Bull. de la Soc. de Chir., 1868 2e série, t. ix., p. 446.
[7] Berlin. klin. Wochenschrift, 1872, No. 6.
[8] Ibid., 1873, No. 34.
[9] Aerztliches Correspondenz-Blatt aus Böhmen, 1875. See also Archiv für Ohrenheilkunde, Band xii., Viertes Heft, 1877.
[10] Wien. med. Presse, 1881, Nos 23, 24, and 25.

into a single nostril, and I prefer this plan. By turning the screw, the blades are gradually separated, and a good view of the interior of the nose is obtained. When the blades are sufficiently opened to press slightly on the nasal alæ, the instrument becomes self-retaining, and the lower part of the speculum falling in front of the lip causes no obstruction to the sight. The great advantage of this instrument consists in its affording an excellent view, while causing no pain, and scarcely any inconvenience to the patient.

Von Tröltsch [1] has taken the screw arrangements of Fränkel's instrument, and replaced the wires by two solid blades, each 3 ctm. in length, but I have not found this speculum so convenient as Fränkel's.

Another speculum, the blades of which somewhat resemble those of

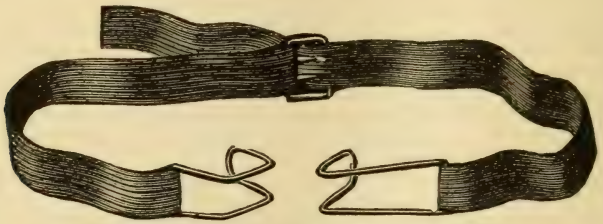

Fig. 24.—Dr. Creswell Baber's Nasal Speculum.

Fränkel's, has been recently invented by Goodwillie,[2] of New York. The instrument is kept open by the elasticity of the wire which connects the two blades. With it, however, it is impossible to regulate the separation of the blades so accurately as with Fränkel's, and hence no fewer than five specula are needed to suit the varying sizes of the nasal orifices. Creswell Baber,[3] of Brighton, uses a speculum (Fig. 24), which consists of two little curved wires, kept in position by a band passing round the head. Spencer Watson [4] employs a modification of Noyes' eye speculum attached to a frontal band worn by the patient. I do not think, however, that either of these instruments is so convenient as Fränkel's. Thudichum's speculum

Fig. 25.—Dr. Thudichum's Nasal Speculum.

(Fig. 25) consists of two flat blades united together, and at the same time kept apart by means of a piece of elastic wire. The objections already mentioned in speaking of Goodwillie's instrument apply to that of Thudichum; besides which, it so often hurts the patient that I have now quite given up its use.

For examining the deeper parts of the nose Duplay's speculum, which

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[1] Lehrbuch der Ohrenheilkunde, Leipzig, 1877, p. 317.

[2] Bosworth: Diseases of the Throat and Nose, New York, 1881, p. 23.

[3] Brit. Med. Journ., 1881, vol. i., p. 55. The instrument is made by Messrs. Wright, of 108 New Bond Street, London.

[4] London Specialist, 1880, vol. i., No. 1.

is a hollow cone-shaped bivalve instrument (Fig. 26 A), is of the greatest service. The two blades of the instrument are slightly flattened, so that the distal end is somewhat beak-shaped, but the inner blade (intended to be applied against the septum) is more flattened than its fellow. The outer blade is movable in the distal four-fifths of its length, and when

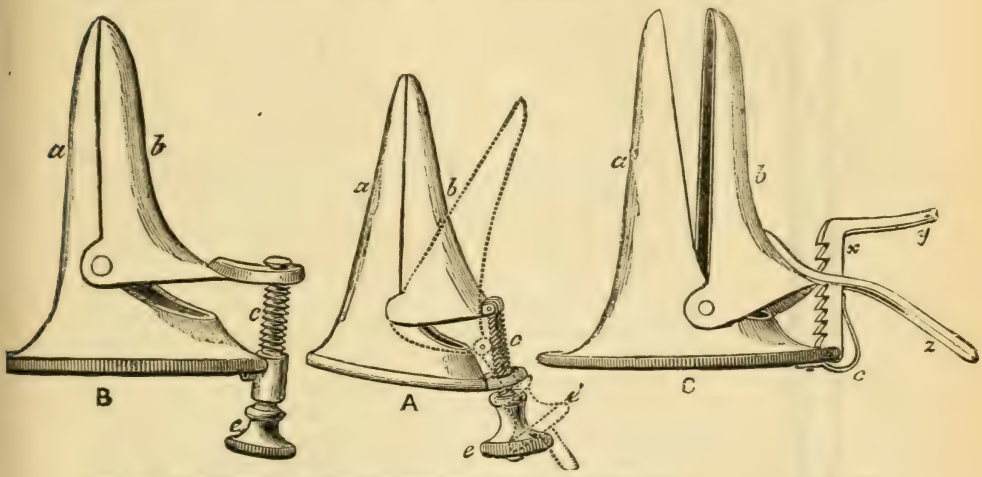

FIG. 26.—Nasal Specula. A, Duplay's speculum: *a* and *b*, the two blades; *c*, male screw; *e*, handle of running screw. The dotted lines show the position of the instrument when fully open. B, Schuster's speculum: *a* and *b*, the two blades; *e*, handle of male screw; *c*, male screw. C, Voltolini's speculum: *a* and *b*, the two blades; *x*, rack; *c*, small spring for keeping *x* in position. When *y* and *z* are held together, the instrument is kept closed, and by pressing on *z* it is opened.

pulled open is fixed in position by means of a *running* screw (Fig. 26 A, *e* and *é*). Its full size is shown in Fig. 26 A, and no larger instrument is ever required, and can seldom be tolerated. It will be seen that the blades open very widely.

Schuster, of Aix-la-Chapelle, has modified Duplay's speculum by em-

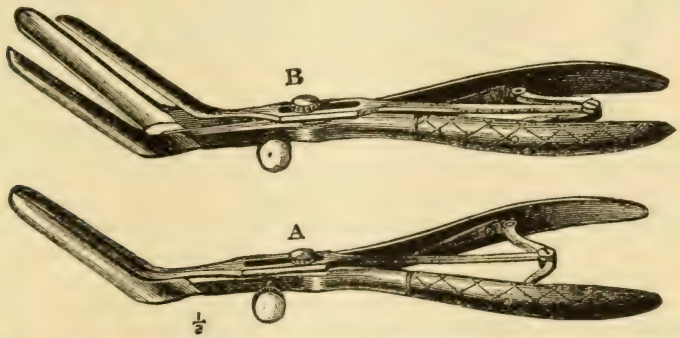

FIG. 27.—Dr. Elsberg's Trivalve Nasal Speculum. A, the instrument closed ready for introduction. B, the instrument expanded.

ploying a *fixed* instead of a running screw (Fig. 26 B). The instrument is rather too large, and yet does not open so widely as Duplay's; but the blades can be opened more gradually, and are thus less likely to hurt the patient. Voltolini (Fig. 26 C) has also modified Duplay's arrangement for opening the speculum, by adapting a rack movement to it, but I have not

found this at all convenient, and the instrument is apt to cause a good deal of pain. Massei[1] again has varied Duplay's speculum, by fenestrating one of the blades, and under some circumstances this instrument is very useful.

Elsberg has invented a trivalve speculum (Fig. 27) by means of which the interior of the nose can be thoroughly inspected. The three blades are separated by closing the handles, or may be more gradually separated by means of a screw in the shank of the instrument. This speculum, however, has the disadvantage of not being self-retaining, and though I occasionally use it, I much more frequently employ one of those previously described. Schnitzler[2] recommends Roth's modification of Kramer's aural instrument further altered by the fenestration of each blade.

FIG. 28.—Zaufal's Funnel. *b* shows the size most frequently used; *a* and *c* are sections of tubes of smaller and larger bore.

For examining the posterior wall of the pharynx and the neighborhood of the Eustachian tube Zaufal's funnel (Fig. 28) is very useful. The instrument is well described by its name, as it is nothing more than a perfectly cylindrical metallic tube, widening at its proximal end into a funnel-shaped mouth. The length of the cylindrical portion of the speculum is from six to eight centimetres, that of the funnel is three centimetres, and total length of the instrument being therefore from nine to eleven centimetres. The diameter of the proximal end is about two centimetres. The instrument is made in five different sizes, the smallest one (called No. 3) having a diameter of three millimetres at its distal extremity, the next (No. 4) a diameter of four millimetres, and the others having diameters of five, six, and seven millimetres respectively. There is no canula with a diameter of either one or two millimetres, as the lumen of such instruments would be too small to permit of satisfactory observation. The range is therefore from No. 3 to No. 7, both numbers inclusive, and of these Zaufal himself most frequently employs Nos. 6, 5, and 4. The interior of the funnel-shaped mouth is blackened, while the cylindrical portion of the instrument has a polished inner surface. Zaufal at first used a pilot sound for passing the speculum through the nose, but has now discarded this. It may be added that he employs the instrument not only for diagnostic, but also for operative, purposes. In the latter case he chooses, if possible, the largest tube, which serves, in fact, as a canula through which he introduces tube-forceps or snares. I have used Zaufal's funnels in a good many instances, but more for the purpose of experiment than with a clinical object. I have, however, fully convinced myself of the possibility of making observations in a considerable proportion of cases. Voltolini,[3] though strongly objecting to Zaufal's instruments, has latterly made use of short funnels

[1] Malattie del tratto respiratorio. Napoli, 1882, p. 178. The instrument was described and figured in a paper read before the Royal Med.-Chir. Society of Naples on May 30, 1875.

[2] Laryngoscopie und Rhinoscopie. Wien, 1879, p. 59.

[3] Rhinoscopie und Pharyngoscopie. Erste Hälfte, p. 81.

varying in length from four to seven and a half centimetres with a lumen of from five to eight millimetres. In connection with these he employs Brunton's otoscope.[1]

Illumination.—For anterior rhinoscopy a good light is required. Sunlight may be employed if it is available, but as this is unfortunately rarely the case in this country, it is better to have some artificial means of illumination. Any of the arrangements for this purpose, which have been already described (see vol. i., pp. 158–168), may be used.

The Application of Anterior Rhinoscopy.

The operator should wear a perforated concave reflector supported by a spectacle frame or frontal band (vol. i., p. 163), while the patient should sit upright opposite him. A good lamp being fixed near the patient's head on the same side as that on which the surgeon wears the reflector, and the nose being tilted up, the vestibule comes into view. This is an irregularly oblong cavity, the outer wall of which (corresponding to the lower two-thirds of the lateral cartilage) extends farther back than the inner, which is formed by the inner returning portion of the lateral cartilage. This space is lined with common integument, and on it grow numerous short coarse hairs, which protect the entrance of the nose. At the upper end of the vestibule is the opening of the anterior nares, the inner, upper, and outer borders of which are sharply defined. On introducing a speculum and separating its blades, the interior of the nostrils comes into view, together with the anterior extremity of the inferior turbinated body and a part of the cartilaginous portion of the septum. If the patient's head be very slightly bent forward, the observer can trace the inferior turbinated body backward, its outer convex surface and lower border being often visible throughout. Between the free edge of this body and the floor of the nose is the inferior meatus, the height of which is rather less than the distance between the upper and lower borders of the inferior turbinated body. A ray of light can generally be projected into the anterior half of the inferior meatus, but seldom beyond this point; and not unfrequently, owing to a slight twist *inward* of the front part of the turbinated body, especially at the point where its anterior and inferior borders meet, only the anterior fourth of the lower meatus is visible. On inclining the patient's head backward, the lower border and the inferior portion of the inner convex surface of the middle turbinated body come into view, while a small portion of its outer concave part can sometimes be seen. The superior turbinated body can occasionally be observed quite at the back and near the vault of the nose, but this is the exception. I have never been able to distinguish the superior meatus from the front. If the patient throws his head very much forward, the floor of the nose can often be followed to the posterior extremity. It is almost always uneven, and frequently presents small irregularly rounded eminences.

The septum can generally be seen, except its upper sixth and posterior eighth. The partition, as already stated (see Anatomy) is seldom quite symmetrical, being often slightly convex on one side, and correspondingly concave on the other. Even when the septum is straight, irregular pro-

[1] This instrument consists of a metallic tube provided with an eye-piece. Into this tube a funnel opens at right angles, through which the light is made to fall on a perforated reflector, which throws the rays through the distal part of the cylinder into an ordinary ear speculum.

jections are often seen, especially at the lower and back part of the vomer. Small exostoses can also often be perceived at the angle where the perpendicular plate of the ethmoid, the vomer, and the cartilage of the septum meet one another.

The color of the lining membrane of the nose varies in different situations. The anterior border of the inferior turbinated body is, as a rule, bright red, and its inferior convex border is mostly of the same hue. The lower border of the middle turbinated body is generally quite pale, and is indeed less vascular than any other portion of the lining membrane of

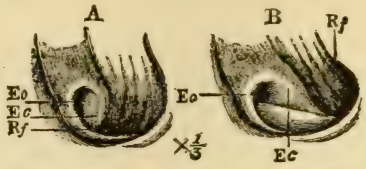

FIG. 29.—The Eustachian Orifice as seen from the Front (after Zaufal). A, the orifice at rest. B, the orifice as seen in deglutition and in certain acts of articulation. *Eo*, Eustachian orifice. *Ec*, Eustachian cushion. *Rf*, Rosenmüller's fossa.

the nose. The floor of the nasal fossa is of a dull red color, while the surface of the mucous membrane covering the septum is pale red.

On looking directly through the nose while the patient's head is inclined slightly forward, the posterior wall of the pharynx can sometimes be seen; and on directing him to swallow, the cushion of the Eustachian orifice may be observed to move upward. A better view, however, of the posterior wall and Eustachian orifice can be obtained with Zaufal's funnel.

MEDIAN RHINOSCOPY.

Wertheim,[1] first suggested the idea of passing into the nose a small tube provided with a steel mirror directed upward, and a corresponding fenestra at its end, like Avery's laryngoscope, and to this instrument he gave the name of "conchoscope." In order to prevent the mirror from becoming soiled by mucus on its introduction into the nose, Voltolini provided the fenestra with a small shield which could be drawn back by means of a thread when the instrument was in position. Voltolini also substituted glass for steel in the mirrors.

The illumination recommended for anterior rhinoscopy is equally applicable to the median method, but the mode of examination itself is seldom of any practical advantage. I may mention, however, that by this plan I once succeeded in obtaining a view of a small polypus situated just above the anterior extremity of the middle turbinated body, which could not be brought into view by any dilating speculum.

POSTERIOR RHINOSCOPY.

History.—The idea of examining the posterior nares by placing a mirror at the back of the mouth, with its reflecting surface directed obliquely upward, appears to have

[1] Ueber ein Verfahren zum Zwecke der Besichtigung des vorderen und mittleren Drittheiles der Nasenhöle, Wien. med. Wochenschrift, 1869, Nos. 18, 19, 20.

occurred to Bozzini,[1] Baumès,[2] and others; but the practical application of the method is undoubtedly due to Czermak,[3] and the art of rhinoscopy dates from a paper published by him in August, 1859. In the following year Semeleder [4] made some remarks on the subject, and later on [5] he brought out a small work which contained many useful directions for rhinoscopy, a number of very interesting cases, and some beautiful colored illustrations. Soon after the appearance of Semeleder's first paper, articles were published by Stoerk,[6] Türck,[7] and Voltolini.[8] To the last-named writer, however, is due the credit of systematically working at the subject for many years, and of having produced the most valuable treatise [9] on rhinoscopy that has yet appeared.

The Rhinal Mirror.—A small laryngeal mirror answers the purpose very well. Its reflecting surface should not be more than 1½ centimetre (⅝-inch) in diameter. An excellent rhinoscopic mirror has been invented by W. C. Jarvis, of New York (Fig. 30), which combines a mirror and tongue-spatula in the most simple and convenient manner. Fränkel has devised an instrument in which the mirror is hinged on to the shank, and this again is

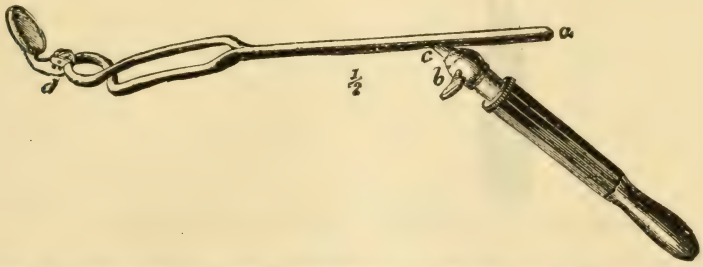

FIG. 30.—Dr. Jarvis' Combined Tongue Depressor and Post-Nasal Mirror. *a*, the shank of the mirror; *b*, the screw by which the shank is fixed to handle; *c*, descending arm of shank; *d*, spring-joint at which the mirror can be fixed at any angle desired. The handle of the instrument can either be continued in the same line of the shank by fixing at *a*, or it can be secured at an angle by screwing it to *c*, as in the woodcut. The expanded portion of the shank acts as a tongue-depressor.

fixed at nearly a right angle to a wooden handle (Fig. 31). By pushing forward a little bar acting on the hinge the angle of the mirror can be changed after its introduction. Michel [10] has also invented a rotating mirror, in which the movement of the glass is rapidly effected by a spring in the handle of the instrument. The disadvantage of this arrangement is that the mirror has to be kept in the desired position by the constant pressure of the thumb on the spring. I may repeat, moreover, in connection with these various rhinoscopes, that I find the ordinary small-sized laryngeal mirror answer every purpose.

Palate Hooks.—The uvula often causes an impediment to posterior

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[1] Der Lichtleiter, oder Beschreibung einer einfachen Vorrichtung, und ihrer Anwendung zur Erleuchtung innerer Höhlen, und Zwischenräume des lebenden animalischen Körpers. Weimar, 1807.

[2] Compte-rendu des Travaux de la Soc. de Méd. de Lyon, 1836–38, p. 62.

[3] Wien. med. Wochenschrift, August 6, 1859.

[4] Ueber die Untersuchungen des Nasenrachenraumes, Zeitschr. d. Gesellsch. d. Aerzte zu Wien, 1860, Nr. 26.

[5] Die Rhinoscopie und ihr Werth für die ärztliche Praxis. Leipzig, 1862.

[6] Rhinoscopie, Zeitschr. d. Gesellsch. d. Aerzte zu Wien, 1860, Nr. 26.

[7] Beiträge zur Laryngoscopie und Rhinoscopie, Zeitschr. d. Gesellsch. d. Aerzte zu Wien, 1860, Nr. 21.

[8] Die Besichtigung der Tuba Eustachii und der übrigen Theile des Cavum pharyngonasale mittelst des Schlundkopfspiegels, Deutsche Klinik, 1860, Nr. 21.

[9] Rhinoscopie und Pharyngoscopie, Breslau, 1879.

[10] Die Krankheiten der Nasenhöhle, Berlin, 1876, p. 9.

rhinoscopy, and various devices have been suggested for the temporary removal of this obstruction. The first instrument invented for this purpose was the palate hook of Czermak. This instrument[1] (Fig. 32, C) consisted

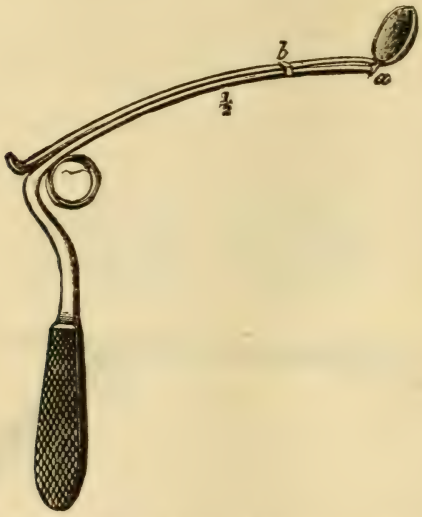

Fig. 31.—Fränkel's Post-Rhinal Mirror. *a*, the hinge; *b*, the running bar.

of a metal rod about four inches in length, one end of which was fixed into a wooden handle, while the other was widened toward the distal extremity and terminated in a short blunt right-angled hook a quarter of an inch in length. Czermak remarks that the size and curve of the hook must vary

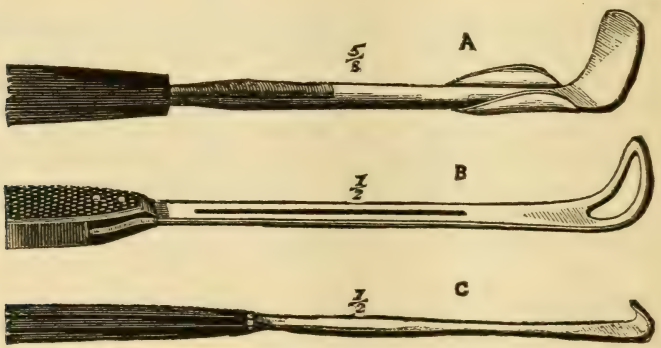

Fig. 32.—Palate Hooks. A. Voltolini's palate hook; B, Fränkel's palate hook; C, Czermak's palate hook.

according to the proportion of the parts. The value of an instrument of this kind is strongly insisted on by Voltolini,[2] who uses a much larger hook provided with two small wings attached to the distal extremity of the shank, just before the bend (Fig. 32, A). The object of these wings ap-

[1] Der Kehlkopfspiegel und seine Verwerthung für Physiologie und Medizin. Leipzig, 1860.

[2] Rhinoscopie und Pharyngoscopie, 1879, p. 17.

pears to be to form a kind of spoon-shaped cavity which supports the uvula in the middle line, thus keeping it from obstructing the view. An instrument of intermediate size and fenestrated at the upturned part of the blade is used by Fränkel (Fig. 32, B), who also occasionally employs an instrument combining a gag, a tongue-depressor, and a groove to hold his palate-hook. But it is very seldom that such instruments, however ingenious, can be successfully employed, and I may remark that I rarely use even a simple hook.

Voltolini,[1] who, as already remarked, is a strong advocate of the palate hook, attaches great importance to his *mode of using it*, which he describes in the following terms: "With the index finger of the left hand the patient's tongue should be strongly depressed, and then, without any ceremony or preparation, the hook having been boldly and quickly passed high up behind the uvula, even to the posterior nares, should be drawn forcibly forward."[2] Voltolini states that he has never met with a patient who could not bear the application of the hook in this way, and he affirms that the uvula yields better to a "forcible grasp than to tender or timid handling." He then proceeds to quote Löwenberg, Monro, Michel, and myself, to show that we all teach that the hook should be used *gently*, and that we consequently fail to appreciate its value. Voltolini maintains that most practitioners have overlooked the physiological law, that a slight irritation causes more reflex action than strong pressure; and he also urges that when this hook is used the soft palate has less power of resistance, the muscles, as it were, losing their point of leverage.

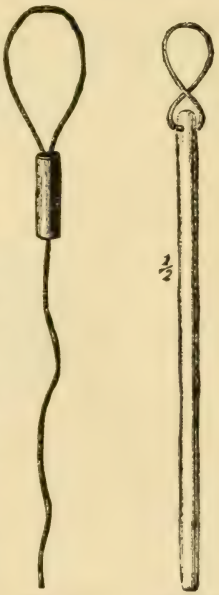

Fig. 33.—Voltolini's Uvula-noose. Fig. 34.—The Authors' Uvula-twitch.

Other Instruments for Drawing the Uvula Forward.—Instead of using a hook, Türck[3] suggested that the uvula should be held with miniature calculus-forceps. He also devised for the same purpose a running noose, consisting of a piece of string passed through a tube. Voltolini[4] modified this somewhat by fixing one end of the string inside the tube (Fig. 33). I have always, however, found it exceedingly difficult to apply this apparatus, but have occasionally employed a "twitch" (Fig. 34), consisting of a small piece of string threaded through the end of a rod four or five inches in length. With this the uvula can be readily caught, and a few twists of the shank will enable the operator to hold the part in any position that he may desire, without crushing or pulling it with undue violence. Dr. Löri, of Buda-Pesth, has invented an instrument, resembling a paper-clip, which has been further improved by Voltolini.[5] It is rather more than three centimetres in length, and to its handles threads are attached, the ends of which pass through the patient's mouth, and can be fastened round one of

[1] Op. cit., pp. 17, 18.
[2] Op. cit., p. 17.
[3] Prakt. Anleitung zu Laryngoscopie, Wien, 1860, p. 65.
[4] Op. cit., p. 10.
[5] Op. cit., p. 12.

the ears. Stoerk [1] proposed to pull the uvula forward by means of a silk ribbon passed through the nose, and brought out through the mouth. The nasal and buccal ends are then tied together and given to the patient, who, by gently pulling, endeavours to draw the velum forward and upward. This plan is open to the obvious objection that the soft palate, instead of being drawn directly forward, is tilted sideways. Surgeon-General Wales,[2] of the American Navy, improved this method by suggesting the use of an elastic tractor, consisting of an india-rubber cord, about two millimetres in diameter. This should be not less than eighteen inches in length, and one end should be carried through each nostril into the pharynx with the help of Bellocq's sound or a gum-elastic cathether. Each end, as it appears below the soft palate, should be seized with the finger or with forceps, and drawn out through the mouth. The middle part of cord is thus fixed by the lower part of the septum in front, and by pulling gently on the free ends which pass through the mouth it will be found that the velum can be drawn forward to any extent that may be desired. The ends may be held by an assistant, or may be tied round the patient's head. I have tried this method of enlarging the naso-pharyngeal space for the purpose of rhinoscopy with some success, but the passage of the cords through the nose into the pharynx is highly disagreeable to the patient, and their contact with the mucous membrane often increases the natural irritability of the parts. Indeed, in addition to the "gagging" which is thus caused, a flow of secretion is sometimes excited, which seriously interferes with the examination. Jarvis, of New York, uses two elastic cords, which are passed through the nose and drawn out by the mouth in the manner just described, but they are fixed over the upper lip by means of clips provided with a small upright plate grooved on the upper edge, so as to serve as a support for the stem of a snare or other instrument which it is desired to use within the nose.

In order to set free one of the operator's hands, the mirror and palate hook have been combined together by Stoerk,[3] Baxt,[4] and Duplay.[5] I cannot say, however, that I have found any advantage from this combination.

Tongue Spatulas.—I seldom employ any instrument for depressing the tongue, but occasionally a spatula may be required. Under these circumstances the instruments of Türck or Fränkel, in which the ordinary tongue-spatula is fitted to a long vertical handle, to be held by the patient well out of the way of the operator, will be found the most convenient.

The Application of Posterior Rhinoscopy.

The examination should be conducted as follows :

The operator should place himself opposite the patient, who must be seated in an upright attitude, with his head erect or bent slightly forward,

[1] Op. cit., p. 95. It may be mentioned that Desgranges (Gaz. Hebdom., 1854, p. 647) proposed a similar method of enlarging the lower opening of the naso-pharynx, and Palasciano actually put it into practice a few years later (Bericht der Naturforscherversammlung in Carlsruhe im Jahre 1858), but in each of these cases the object was to open a wider way for digital examination of naso-pharyngeal growths. Stoerk was, so far as I know, the first who had recourse to such a means of controlling the velum for rhinoscopic purposes.

[2] New Method of Rhinoscopic Exploration, Washington, 1877, p. 7.

[3] Zur Laryngoscopie. Wien, 1859, p. 20.

[4] Berlin. klin. Wochenschrift, 1870, No. 28.

[5] Traité Élém. de pathol. externe, Paris, 1877, t. iii., p. 752

the lamp being in the same position as in laryngoscopy. The patient should be directed to open his mouth widely, and the light should be made to fall rather lower in the fauces than when it is desired to examine the larynx. The rhinal mirror should then be carried to the back of the throat, its upper border being a little below the curtain of the palate, and its face directed upward, so as to form an angle of about 135° with the horizon. If the uvula happens to be drawn upward and backward, as is often the case, the patient should be told to expire gently, or to produce some nasal sound, such as *hang*. Straining and forced inspiration must be especially avoided. It is sometimes necessary to depress the tongue with a spatula, but the shank of the rhinal mirror generally answers sufficiently well.

It is a good plan to pass the small mirror between the anterior pillar and the uvula on one side first, and then to withdraw it and introduce it again in the same manner on the opposite side. By slanting the mirror a little laterally the posterior corners of the naso-pharynx with the orifice of

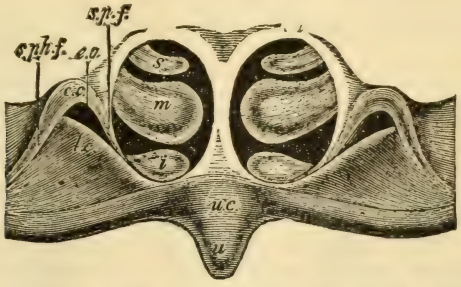

FIG. 35.—Post-Rhinal Image. *s*, superior turbinated body; *m*, middle turbinated body; *i*, inferior turbinated body; *e.c.*, Eustachian cushion; *e.o.*, Eustachian orifice; *u.c.*, uvula cushion; *u*, uvula; *s.ph.f.*, salpingo-pharyngeal fold; *s.p.f.*, salpingo-palatine fold.

the Eustachian tubes and the folds which bound them come into view; the vault of the pharynx is seen when the mirror is nearly horizontal. When the glass is held in a nearly perpendicular position, the upper part of the arching posterior wall of the pharynx can be perceived, but the laws of perspective reduce this view to the narrowest limits. To inspect even one side of the naso-pharynx thoroughly, however, it is often necessary to introduce the mirror several times, and to turn its reflecting surface in different directions; hence the post-rhinal image (Fig. 35) is a compound picture made up of many limited views. In the middle the septum is seen forming a thin projecting partition between the choanæ, slightly thicker above and below than in its central portion. The most conspicuous objects are the middle turbinated bodies, which appear as two pale oblong tumors extending downward and inward from the outer walls toward the septum, and occupying the middle third of the choanæ. Above the middle turbinated bodies the superior ones are seen as small, grayish, horn-shaped projections running in the same direction as those just below them but not extending so far inward. At the bottom of the nasal fossæ the inferior turbinated bodies appear as two pale, rounded, solid-looking prominences, redder in color than the middle turbinated body, and somewhat nearer the septum. The meatuses, as might be expected by those acquainted with the anatomy of the parts, are not very distinct. The superior meatus, though actually the smallest and most

shallow, sometimes appears, owing to the upper turbinated body being so little developed, as the largest. The middle meatus can generally be made out, but the lower one is either not visible at all or appears only as a narrow slit below the turbinated body and close to the septum. On the outer wall of the naso-pharynx the yellow orifice of the Eustachian tube can be seen, bounded by the salpingo-palatine fold on its inner, and the salpingo-pharyngeal fold on its outer side; the base of the opening being formed by a projection, described by Zaufal as the "levator-cushion." External to the salpingo-pharyngeal fold is Rosenmüller's fossa. Beneath the septum the base of the uvula containing the azygos muscle forms a slight projection, called the "uvula-cushion." When the mirror is held obliquely so that its reflecting surface approaches the horizontal position, the vault of the pharynx comes into view, and at its anterior part a number of pale pink elevations and depressions are seen together, constituting a small irregular body of adenoid tissue, known as Luschka's tonsil (see Anatomy, vol. i., p. 2). Quite in the centre of this there is often an opening, which has been called the mouth of this gland, but is really a small spot free from gland tissue. Behind this tonsil the smooth grayish surface of the vault of the pharynx with its median raphé is sometimes visible.

Posterior Rhinoscopy by Double Reflection.

Voltolini[1] has suggested the use of two mirrors for posterior rhinoscopy, more especially with the object of obtaining a good view of the Eustachian orifice. One mirror with a long curved shank bent at a right or even a slightly acute angle is passed well up into the naso-pharynx, close to its posterior wall, in such a way that the reflecting surface is a little above the level of the choanæ; while a second mirror is introduced in the usual manner, but its reflecting surface is kept in a somewhat more horizontal position, so that instead of directly receiving the image of the posterior nares it receives a secondary image, first formed in the upper mirror. In employing these mirrors the uvula has to be held forward by some of the special arrangements already described. This method is so complicated and so rarely capable of application that it requires only a passing notice. Voltolini has, however, reported one case[2] in which, by using two mirrors, he was able to see the Eustachian orifice, into which a catheter had been previously introduced.

Auto-Rhinoscopy, Magnifying Mirrors, etc.—The observations which have been already made upon the kindred subject of Auto-laryngoscopy (see vol. i., p. 175) apply equally here.

NASAL INSTRUMENTS.

Nasal Probes.—Useful information as to the condition of the mucous membrane, the attachment relations and density of growths, the presence of exposed surfaces of bone and various other matters can often be obtained by examining the interior of the nose with small probes. These instruments may be either straight or slightly hooked at the end, the

[1] Die Rhinoscopie, etc., 1879.

[2] Op. cit., p. 179.

curved portion being somewhat broad and flat, and, of course, blunt at the edge. Nasal probes, in fact, resemble those recommended for the larynx (vol. i., Fig. 26, p.179), as regards the distal extremity, but the stem is straight, and is fitted into a handle, at an angle of about 135°.

Nasal Bougies.—These are useful, both for purposes of diagnosis and of treatment. They are made of gum-elastic or vulcanite, and are from three to four inches in length. They may be round, or slightly flattened from side to side like the œsophageal bougies (see p. 8), and I generally find six sizes sufficient, viz., from three to eight millimetres in the short transverse diameter, *i.e.*, from one flattened surface to the other. It greatly facilitates the use of these instruments if they are probe-pointed. In introducing the bougie the flattened sides are, of course, directed toward the septum and the outer wall of the nasal fossæ respectively.

Shields.—In applying strong caustics, or in using the electric cautery within the nose, shields are sometimes required to protect the healthy parts from injury. Shurly,[1] of Detroit, has invented two instruments for this purpose. One of them (Fig. 36) is a modification of the nasal dilator,

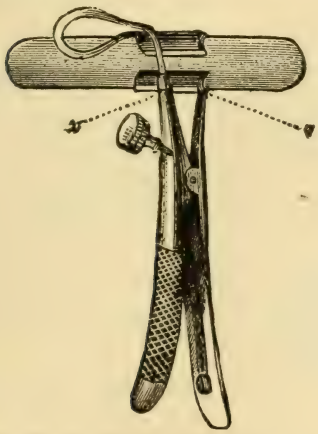

FIG. 36.—Dr. Shurly's Nasal Shield. At the points *x* and *z* the blade and plate can be reversed. The instrument can thus be made applicable for either nasal passage. As a rule it is for the purpose of protecing the septum while the operator is making applications to growths on the turbinated bone, that the ivory plate is required.

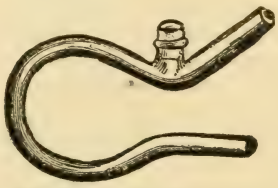

FIG. 37.—Mr. Bryant's Auto-Insufflator.

or speculum, one blade being replaced by an ivory plate. The other instrument consists of an ivory plate, which is passed into the nasal fossa, and a wire spring attached to it, which is applied to the ala of the nose externally. Both these instruments are occasionally useful, but if it be possible to dispense with them it is desirable to do so, as any shield, however well made, impedes the view and diminishes the space available for manipulation.

Insufflators.—For the application of remedies in the form of powder, the tube-insufflator (vol. i., Fig. 39, p. 185) may be used, or the patient can apply the powder himself, by means of Bryant's auto-insufflator.[2] This consists of a bent tube, provided at one part with a corked opening

[1] St. Louis Med. and Surg. Journ., January 5, 1880.
[2] Practice of Surgery, London, 1872, first edition, p. 124.

for receiving the powder. The instrument having been charged, the patient puts one end of the pipe in his mouth and the other up his nose, when, by gently blowing, the powder is driven into the nasal fossa. Andrew Smith has constructed an insufflator on the model of the hand-ball spray-producer, which can be used either for the anterior or the

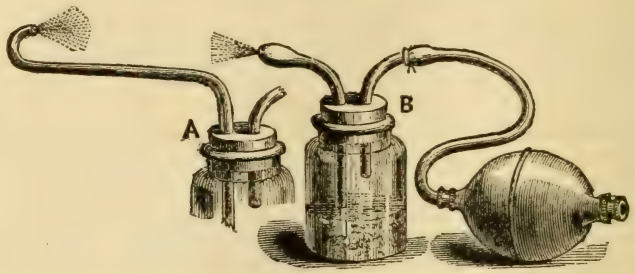

FIG. 38.—Dr. Andrew Smith's Insufflator. A shows the nozzle required for the posterior nares; B, that for the anterior.

posterior nares. It consists of a glass bottle, with an india-rubber stopper which is perforated to allow the passage of two tubes. One of these reaches but a short way into the bottle, and is connected outside with an ordinary elastic hand-ball, by means of a piece of flexible tubing, the other almost touches the bottom of the bottle, while its free portion is straight, and somewhat bulbous at the end, or when intended for post-nasal use, longer, and curved upward and slightly backward, as shown in the cut (Fig. 38, A). The receptacle being partially filled with powder the ball is squeezed once or twice, when a small quantity of the contents of the bottle will be forced out through the nozzle. Clinton Wagner has lately brought under my notice a still more simple and handy apparatus, in which a test-tube takes the place of the bottle above described.

Brushes.—For the application of remedies to particular spots in the

FIG. 39.—Nasal Brush. This instrument shows the angle at which all nasal instruments should be bent.

front part of the nasal passages a fine brush fixed to a handle at a suitable curve is often serviceable. For the posterior nares and naso-pharynx the laryngeal brushes Nos. 1 and 2 (vol. i., p. 180) answer every purpose.

Caustic Holders.—Some caustics can be applied with the brush just described, and nitrate of silver may be conveniently used by simply fusing it on a metal rod (vol. i., p. 185); but various instruments have been invented with the view of protecting the contiguous parts from the action of the caustic. A very useful instrument for the application of the solid nitrate of silver has been devised by Schrötter. It consists of a long grooved probe, provided with a turning shield, which covers the groove, into which the nitrate of silver is fused. The instrument should be introduced close to the part which it is desired to cauterize, when the shield is turned aside, and the caustic brought into contact with the tissue to be destroyed.

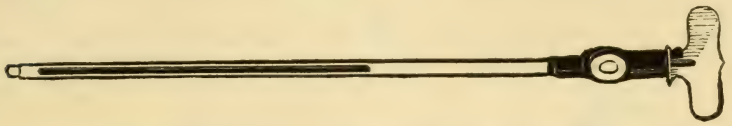

FIG. 40.—Prof. Schrötter's Porte-caustique (after Beverley Robinson).

For applying strong nitric acid and similar escharotics Andrew Smith's instrument, which has been somewhat modified and improved by Beverley Robinson (Fig. 41), is very useful. It consists of a grooved director, made of vulcanite, and bent at a suitable angle. Into the groove a slender steel wire, armed with cotton-wool, is introduced a short way, and a few drops of acid are placed on the exposed surface of the wadding. The whole instrument, after being oiled, is then passed into the nasal fossa, and the wire rod carried along the groove as far back as may be desired. On withdrawal of the wire any excessive action of the caustic is neutralized by the passage of a similar wire, the wadding of which has been steeped in a solution of bicarbonate of soda. A more simple method is that recommended by Harrison Allen,[1] who employs a tapering rod of soft iron, slightly roughened at the distal end for the more secure attachment of a pledget of cotton-wool, which is wound round it. The proximal extremity of the rod is fitted into a wooden handle. The rod may be bent to any shape that may be wished, and the cotton-wool can be soaked with any solution that is thought desirable; the instrument should be introduced into the nose through a speculum.

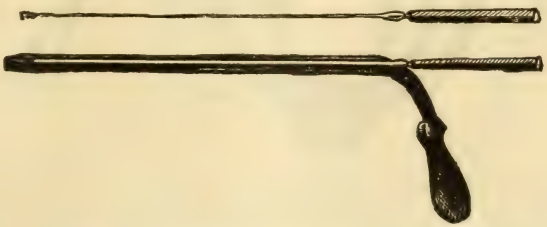

FIG. 41.—Dr. Andrew Smith's Modified Caustic Holder.

Hand Washes.—These require no apparatus, the medicated liquid being drawn up into the nose from the hollow of the hand. A small quantity of

[1] Amer. Journ. Med. Sci., New Series, No. clvii., 1880, p. 62 et seq.

tepid water, in which chloride of sodium, carbonate of soda, or some other medicament has been dissolved, is used in the manner described, and when it comes into the mouth is spit out. Rumbold,[1] of St. Louis, has shown that the direction which fluids take in passing through the nose depends on the position of the patient's head. In order, therefore, that the wash may reach all parts of the nasal cavity, the patient, while sucking up the fluid through the nose, should be enjoined first to bend his head forward and downward, then to keep it in a nearly erect position, and finally to throw it as far back as he is able while drawing up the medicated liquid.

Douches.—The douche, or irrigator, was introduced by Thudichum,[2] who first applied Weber's[3] discovery that the nasal channels act as two arms of a siphon, when the mouth is kept open. Thudichum's original instrument consisted of a piece of india-rubber tubing, about four feet in length, provided at one end with a perforated weight, and at the other with an appropriate nozzle for passing into the nostril. The weighted end of the tubing is put into a vessel containing the medicated liquid, and the latter is placed on a shelf a little above the patient's head. On starting the flow by suction at the nozzle, and placing the instrument in the nose, the fluid will run in a continuous stream until it is exhausted. This instrument has since been somewhat improved (Fig. 42) by the addition of

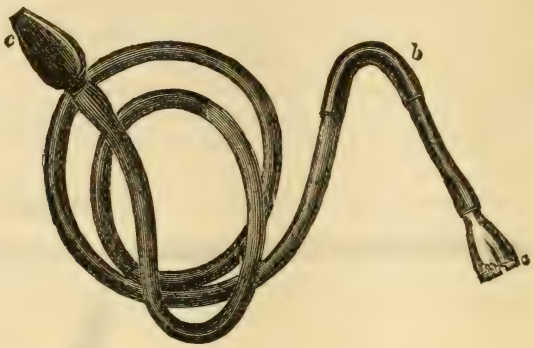

FIG. 42.—Nasal Douche. Elastic tubing terminating at *a* in a hollow metal weight, and at *c* in a nozzle, while at *b* is a metal or vulcanite shoulder, fitting loosely, so that it can be run along the tubing. *a*, the metal piping is placed at the bottom of a bottle or jug containing tepid saline water; *b* rests on the edge of the vessel; and *c* passes into the nose of the patient. In order to start the current, suction must first be made at the nozzle.

an arm of vulcanite or metal, to cover the tube where it passes over the edge of the vessel, an arrangement which prevents the tubing from being pressed upon, and dispenses with the necessity of a weight.

The Parson's douche is a still more perfect instrument, being provided with an elastic ball, by means of which the flow can be started, and a tap by which the stream can be at once shut off.

About a pint of water at a temperature of 90° Fahr. should be used, one drachm of chloride of sodium or carbonate of soda having been first dissolved in it. A few years ago irrigators were tried on a very extensive scale, but the observations of Roosa,[4] of New York, and others, showed that fluids introduced through the nose occasionally pass into the Eusta-

[1] Hygiene and Treatment of Catarrh, St. Louis, 1880, part i.
[2] Lancet, November 24, 1864.
[3] Müller's Archiv., 1847, pp. 351–354.
[4] Arch. of Ophthal. and Otology, vols. i., ii., and iii.

chian tube, and excite severe inflammation of the middle ear. The accident is most likely to occur from the fluid being driven through the nose with too great force, or from the patient swallowing while using the instrument. Common salt is ordinarily employed for the purposes of irrigation, but Weber-Liel [1] has found that carbonate of soda is less likely to produce a serious result, should any fluid find its way into the middle ear. Solis-Cohen,[2] who strongly insists on the value of this method of treatment, has noticed that the accident generally occurs when cold, instead of warm water, is used; and he calls attention to the fact that Cassels has tried it in 1,500 cases without ever having seen or heard of an untoward result. I do not employ irrigation nearly so frequently as formerly; not

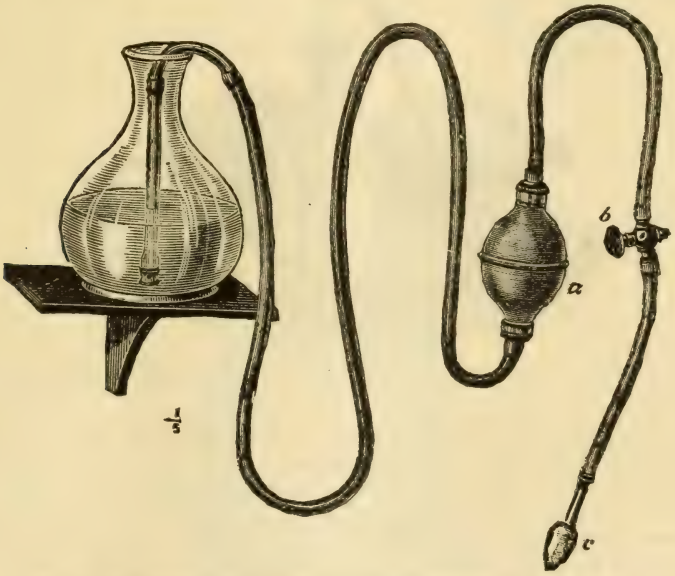

FIG. 43.—The Parson's Nasal Douche. *a*, elastic hand-ball; *b*, tap; *c*, nozzle.

because I have noticed any injurious effects from it, but because I have obtained equally good results from sprays, which, as a rule, are much less disagreeable to the patient.

Spray Producers.—There are a great variety of these instruments, most of those already described in connection with laryngeal disease (vol. i., p. 182) being also serviceable in affections of the nose. As a rule, however, it is best to use an apparatus, the nozzle of which can be passed some distance into the nasal fossa. Two kinds of spray-producers are required, viz., the anterior and the posterior.

The ordinary anterior nasal spray-producer (Fig. 44) consists of a silver pipe about three inches long, terminating in a fine perforated point, and provided with a piece of tubing and an elastic hand-ball.

The same apparatus can be used for the posterior nares, but the tube carrying the medicated liquid should pass in a nearly horizontal direction from the bottle, and its extremity should be directed upward and slightly

[1] Deutsche Zeitschr. f. prakt. Med., 1877, No. 30.
[2] Diseases of the Throat, etc. Second edition, p. 360.

backward (Fig. 45). Lefferts prefers a *conical* nozzle (Fig. 46) which accurately fits into the nostril, and thus prevents any return of the medicated fluid. Owing to the prevalence of catarrh of the naso-pharynx in America, and the necessity of thoroughly cleansing that cavity when diseased, great

FIG. 44.—Anterior Nasal Spray-Producer. Though a reserve ball for continuous spray is shown in the cut, one ball is quite sufficient.

attention has been given by physicians in the United States to the subject of spray-producers, and both the air-pump and water-power have been brought into requisition to give force and steadiness to the spray. The most convenient pneumatic spray-producer is that of Livingston (Fig. 47). It consists of an outer cylindrical chamber resting on a broad iron stand, and provided with an air-pump and pressure-gauge, the tube of which can

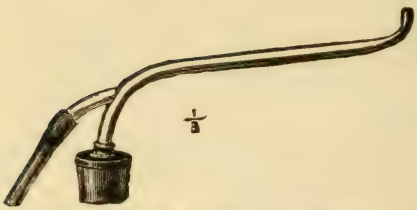

FIG. 45.—Posterior Nasal Spray-Producer.

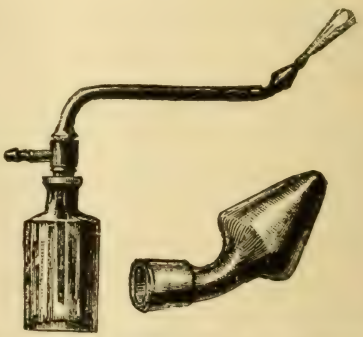

FIG. 46.—Dr. Lefferts' Nasal Spray-Producer with Conical Nozzle (after Beverley Robinson).

be shut off from the air-chamber when desired. To the top of the receiver is fitted a long piece of elastic tubing, provided with a turn-tap at its point of exit, which communicates at its further end with the horizontal and per-

pendicular tubes of a spray-producer. In immediate connection with these tubes, and intervening between them and the elastic pipe of the pneumatic

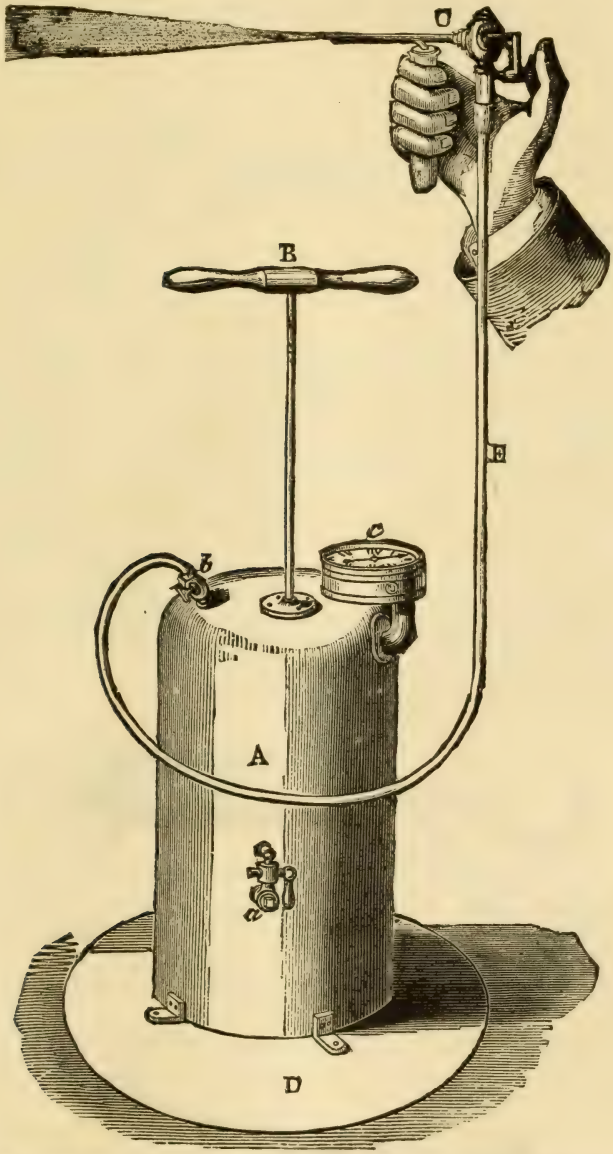

FIG. 47.—Dr. Livingston's Pneumatic Spray-Producer. A, air-chamber; B, handle by which the condensing pump is worked; C, spray apparatus, consisting of two slender metal tubes, one of which issues from a test-tube holding the medicated fluid, while between the other (horizontal) tube and the elastic pipe E, connected with the air-chamber, there is a spring-valve which is governed by the thumb of the operator; *a*, communication (fitted with a turn-tap) between the pump and the air-chamber; *b*, stopcock between A and E; D, stand; *c*, pressure-guage.

machine, is a little piece of metal tube bent at a right angle, and provided with a spring-valve which controls the communication with the air-cham-

ber. The perpendicular tube of the spray-apparatus passes into a common test-tube which contains the medicated fluid, and the operator, while holding the test-tube with his fingers, can manage the valve with his thumb. The tubes of the spray-apparatus are modifications in metal of Sass' glass tubes, and their adaptation to the air-pump permits the spray to be projected in any direction with an amount of force which can be accurately regulated.

In place of the air-pump, a hydraulic arrangement can be employed, a cistern at the top of the house supplying the pressure. A number of test-tubes containing different medicated fluids are all in communication with an air-chamber, kept constantly full of condensed air by the aid of the water-pressure derived from the cistern, and the operator, at a moment's notice, can make any spray-application desired. I recently saw an excellent form of this ingenious arrangement in working operation in the consulting-rooms of Dr. Cheetham, of Louisville, Kentucky, and it seemed to me to constitute the best method of employing sprays hitherto invented.

Inhalations.—Medicated steam inhalations used through the nose are sometimes serviceable, although seldom so beneficial as in the case of inflammation of the throat. Most of the inhalers already described (see vol. i., pp. 182, 184) are provided with a special nozzle adapted for nasal inhalation, but the best instrument for the purpose is one lately devised by Dr. Whistler.[1] This consists of a vulcanite mould of the tip and alæ of the nose, from the upper surface of which project two hollow conical pieces for insertion into the nostrils, while to the under part is attached a cylindrical chamber which, by means of india-rubber tubing, can be made to communicate with an inhaler. The patient can, however, use this form of medication without any apparatus whatever, by inhaling through the mouth and forcing the vapor back through the posterior nares, as is often done by tobacco-smokers.

Syringes.—For the injection of fluid through the anterior nares an

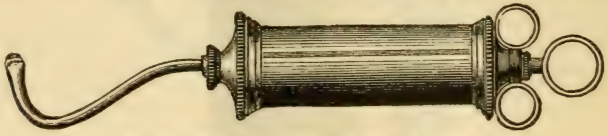

FIG. 48.—Dr. Solis-Cohen's Post-nasal Syringe.

ordinary straight glass or vulcanite syringe will serve perfectly, but for cleansing the posterior nares Solis-Cohen's instrument, which has a suitable curved nozzle (Fig. 48), will be found most useful. The point is perforated with many small holes like a rose, so that the fluid is thrown out in all directions.

Cutting Instruments, Forceps, etc.—For cuttting away vegetations or

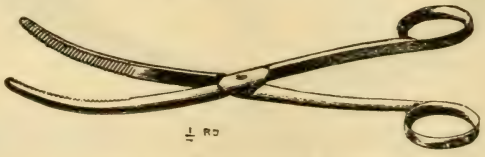

FIG. 49.—Ordinary Polypus Forceps.

removing polypi, forceps or snares may be employed. The old-fashioned forceps still commonly used by general surgeons for the evulsion of polypi

[1] Med. Times and Gaz., 1882, vol. ii., p. 737.

are shown in the annexed woodcut (Fig. 49). The blades are serrated for about half their length, and are slightly curved. This forceps can often be employed successfully, but it is somewhat large, and the handle being in a line with the blades, both the instrument and the operator's hand obstruct the view of the growth.

FIG. 50.—Mr. Gant's Vine-scissor Forceps.

Mr. Gant has invented a scissor forceps (Fig. 50) on the principle of the vine or flower-scissors, one edge of either blade being like that of an ordinary scissors, and the other broad and rasped, so as to insure firmness of grasp, and to retain the growth after it has been divided. This instrument may be useful when the growth is unusually hard, but it is open to the objection already urged against the common forceps, viz., that it obstructs the view.

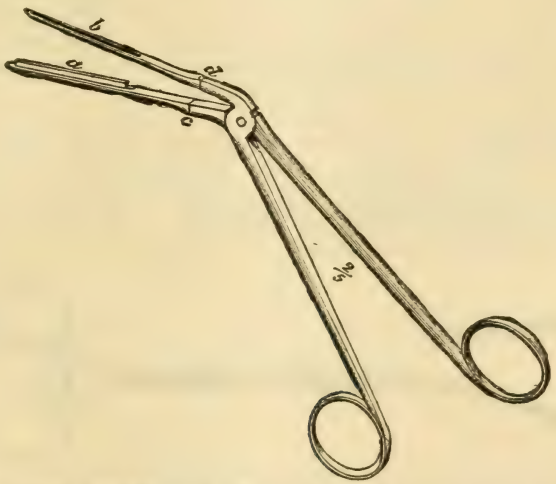

FIG. 51.—The Author's Punch-Forceps.[1] *a*, small ridge or "punch," fitting, when the blades are approximated, into *b*, a fenestra in the corresponding portion of the other blade; *d* and *c*, joints where the male and female blades can be removed and their positions reversed, or, if desired, different kinds of blades may be substituted.

The instrument which I generally use, and which in my hands has proved thoroughly satisfactory, is my "punch-forceps" (Fig. 51). The handles are placed at such an angle as to be altogether below the level of the blades, so that the surgeon's hand in no way impedes his sight when operating. The blades themselves are slender and open in the vertical

[1] This instrument, as well as the various others which have been invented by the author, is made by Messrs. Mayer & Meltzer, Great Portland Street, London.

direction, so as to be well adapted for working in a narrow space. The special feature of the forceps, however, is that the lower blade carries on its surface a small projecting bar or punch of metal, corresponding to a fenestrated portion in the upper blade. A growth seized with these blades is generally cut through at once, but, if not, the forceps can of course be used for evulsion in the ordinary way; or if it be desired, the blades can be changed and blunt ones substituted.

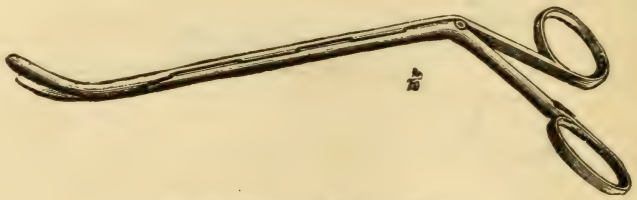

FIG. 52.—The Axial Polypus Forceps.

For the removal of very small growths situated in the upper part of the nose, the axial forceps, constructed on the principle of Burge's œsophageal instrument, in which, while the blades themselves open widely, their shanks scarcely move, will be found useful (Fig. 52).

Beverley Robinson has modified the ordinary polypus forceps by making the point longer and more slender, and providing the handles with a lock (Fig. 53). The inner surface of the blades, moreover, has a groove along the middle, while the edges on each side are deeply serrated. This feature, combined with the locking of the handles, gives the instrument a powerful grip, and, according to Robinson, renders it very suitable for the evulsion of hypertrophied mucous membrane.

A rotary forceps for the extraction of polypi has been invented by my colleague, Dr. George Stoker, whereby, after the pedicle of the growth has been seized between the blades of the instrument, these can be fastened together by means of a spring catch, and then twisted on their own axis by turning a small handle. Fig. 54 shows the mode of action of the instrument with sufficient clearness.

FIG. 53.—Dr. Beverley Robinson's Toothed and Locking Forceps. *a*, lock by which the handles can be fixed together; *b*, separate view of one blade, showing the grooved centre and the serrated edges.

For the removal of portions of the turbinated bones and nasal exostoses, I have had an instrument made which combines the grasping power of ordinary forceps with a cutting blade. The instrument (Fig. 55) consists of deeply grooved blades, somewhat flattened from side to side, opening vertically, and constituting a tube when closed. Each blade, in point of fact, is a half tube, and has therefore an inner and an outer edge. The inner edges of each blade (those which, when the instrument has been introduced, are nearest the septum) are slightly serrated to enable the operator to seize the turbinated bone securely. Within the tube formed by the closed blades, a third blade, bevelled at its anterior extremity to a sharp

edge, like a chisel, can be projected forward when the instrument is in position. The forceps is introduced with the chisel drawn back, and the

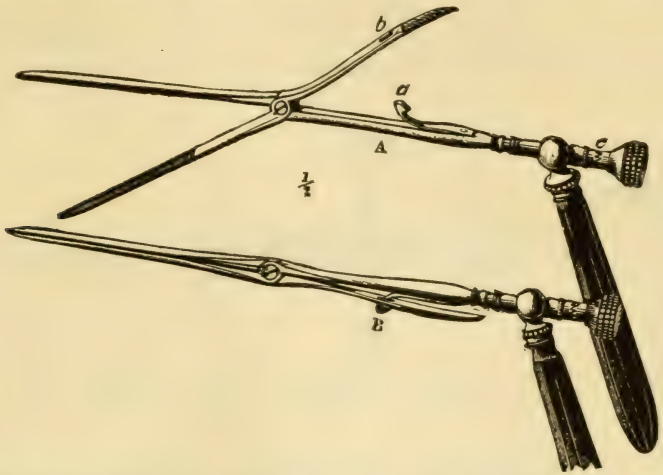

FIG. 54.—Dr. George Stoker's Rotary Polypus Forceps. A shows the instrument open; *a*, the spring catch; *b*, slit through which *a* passes when the blades are brought together; *c*, double cog-screw, allowlowing the stem of the instrument to be twisted round independently of the handle. B shows the blades locked and partly turned round.

tissue to be removed having been firmly grasped with the forceps, the cutting point is driven home with the operator's free hand.

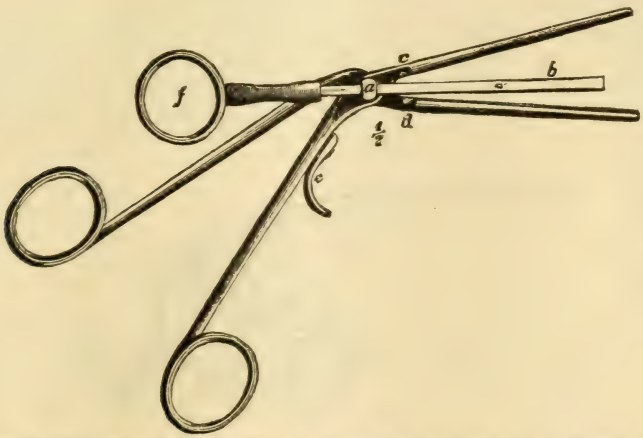

FIG. 55.—The Author's Nasal Bone-Forceps. *a*, central pivot, through the perforated extremity of which slides *b*, connected with the handle, *f*; *c*, upper, and *d*, lower blade of the forceps; *e*, rest for the operator's right forefinger.

Snares and Écraseurs.—Snares have been used for many years for the removal of polypi. The best known instrument of this sort is that of Hilton[1] (Fig. 56), which consists of a quadrangular shank, terminating at

[1] For information concerning the origin of this instrument, see the History of Non-malignant Tumors of the Nose.

one end in a ring for the thumb of the operator, and at the other in a tapering nasal portion. A cross-bar to which the ends of the wire are secured slides on the quadrangular part of the shank. The distal end of the nasal part is bulbous, and is perforated in the longitudinal direction with two holes, through which the wires pass to form a loop beyond the point of the instrument. This instrument has been improved in recent

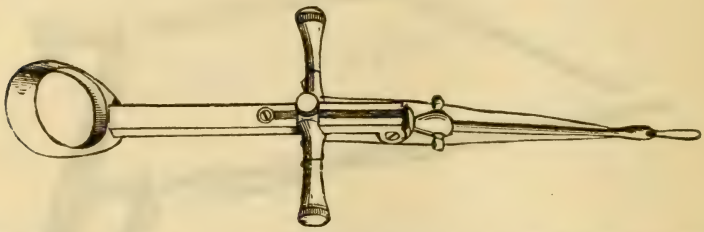

FIG. 56.—Hilton's Improved Snare. (This instrument has now only an historical interest, having been superseded by snares of simpler and more convenient construction.)

years by Clarence Blake, of Boston, Mass., Zaufal, and myself. The straight shank was first bent at a suitable angle by Blake, an arrangement permitting an uninterrupted view of the entire operation of evulsion. In Zaufal's instrument the wire at its distal extremity rests on two little rods, and the loop is only formed when the rods are thrust forward. The loop, therefore, is not bent or pushed on one side, as is apt to be the case during its introduction into the nose, and the wire is only "paid out" when the tip of the instrument is close to the polypus.

My own improvements consist in slight modifications of Blake's instrument, by which it can be more easily held, and the wire more readily pulled home. In my snare (Fig. 57) the thumb of the practitioner, after passing through a ring on the upper surface of the handle, is received into a slightly concave metallic rest, which can be slid along the handle and

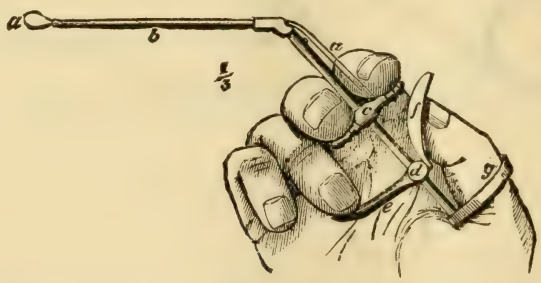

FIG. 57.—The Author's Polypus Snare. *a*, the wire; *b*, tube along which the wire is passed; *c*, centre-piece of the cross-bar; *e*, finger-rest; *d*, centre-piece to which *e* and *f* are fixed; *f*, thumb-rest; *g*, ring for thumb.

fixed at any point which suits the hand of the operator. Below this rest a tapering trigger-shaped crutch projects, upon which the tip of the ring-finger is placed.

The great attention which has recently been given to hypertrophy of

the turbinated bodies has led to the invention of several instruments for the removal of the redundant tissue. Among these must be especially mentioned a very delicate, and at the same time highly practical form of snare which has been devised by Jarvis, of New York.[1]

The instrument (Fig. 58) consists of a straight nickel canula, seven inches in length and one-sixteenth of an inch in diameter. Its outer surface is smooth for four inches from the distal end; but for the rest of its length it is wormed. Over this portion is fitted a second canula somewhat larger in bore; this is smooth exteriorly, but grooved on its inner surface to prevent any rotation. Over the screw-thread runs a small wheel, half an inch in diameter, and three-sixteenths of an inch thick, roughened on the outer edge, and so arranged as, when it is turned, to push before it the movable canula. At the proximal extremity of this outer tube are two small pins, round which the ends of the wire may be secured after being drawn through the whole length of the inner canula. The loop of wire that projects from the distal extremity of the canula may, of course, be of any size that is required. The advantages of the instrument are that it can be easily worked, and that the loop of wire may be tightened, either *slowly* by turning the wheel and thus gradually pushing down the outer tube on which the wire is fixed, or *quickly* by pulling back the outer tube itself. It is obvious that this little instrument is well adapted for removing mucous polypi as well as hypertrophied mucous membrane.

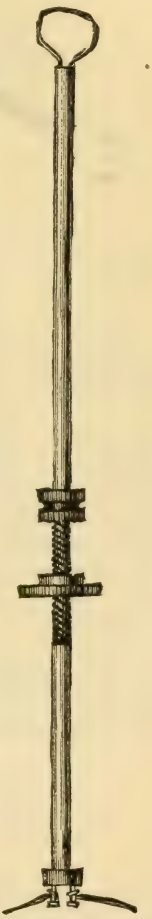

Fig. 58.—Dr. Jarvis' Nasal Écraseur (after Bosworth).

My former assistant, Jefferson Bettman, now of Chicago, Ill., has modified Jarvis' instrument by having the end of the tube flattened, so that the point of exit of the wire can be placed in closer apposition to the surface on which it is desired to operate. The modified snare, moreover, is made in several parts, and tubes of various calibre, length, and shape, can be substituted for the original straight one. By this means the snare can be used for the posterior nares. Another advantageous feature in Bettman's snare is that instead of having to be twisted round pegs, the free ends of the wires are fixed by means of a clamp screw, which can be tightened or slackened at pleasure.

An excellent modification of Jarvis' snare has lately been made by Bosworth,[2] who has had it bent at the proper angle for nasal instruments.

Écraseurs.—For the removal of the denser varieties of polypus, I have found the écraseur represented in the followying woodcut (Fig. 59) very useful. In this instrument the wires are threaded through a barrel and wound round two reels by means of a lever, which works a cog-wheel.

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[1] The value of the *principle* of this instrument may be gathered from the fact that within six months of its description having been published, no less than seven modifications or so-called "improvements" were brought out in America and England.

[2] Philadelphia Med. News, February 24, 1883, p. 230.

The barrel is about nine centimetres in length, and is flattened for about twenty millimetres at the distal end to allow of more easy insertion into a narrow channel.

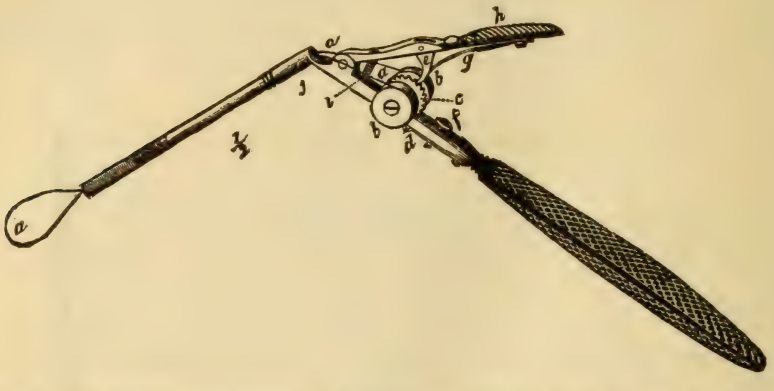

FIG. 59.—The Author's Nasal Écraseur. *a*, the wire passing from the end of the barrel to the two reels *b*; *c*, cog-wheel; *d*, stop-spring, which, by pressing on the button *f*, is released, allowing the reels to be unwound; *e*, tooth controlled by the spring *g*, which in its turn is acted on by lever *h*; *i*, spiral spring raising lever after use; *j*, short cylindrical portion of shaft in which the proximal end of the barrel is contained.

Electric Cautery.—The electric cautery is extremely useful for the destruction of polypi, of hypertrophied mucous membrane, and cartilaginous outgrowths. For application within the nose any of the electrodes already described (vol. i., p. 372) can be employed, the wires, however, being previously suitably bent. For the last four years I have employed Schech's admirable electrodes,[1] which enable the operator to treat almost any case. For the application of cautery to the central portion of the nasal fossa Löwenberg's instrument (Fig. 60) has, however, the great advantage that it can be readily used without a shield; for the incandescent point, instead of being placed at the distal extremity of the electrode, is situated at the side on one of the wires, so that when in the nose the other wire protects the healthy parts.

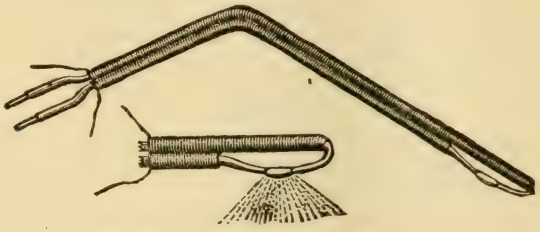

FIG. 60.—Dr. Löwenberg's Nasal Electrode.

For applying the electric cautery to the vault of the pharynx, Lincoln has invented an ingenious apparatus (Fig. 61). It consists of an electrode, around which is fixed a spiral spring, ending in a bell-shaped shield of bone, which projects beyond the electrode and conceals a platina disk which terminates the electrode. When the instrument is pressed against

[1] Made by Albrecht, of Tübingen, at a very moderate cost.

the tissue to be destroyed, the shield is forced back on the spring, and the electrode is thus allowed to come into contact with the affected part.

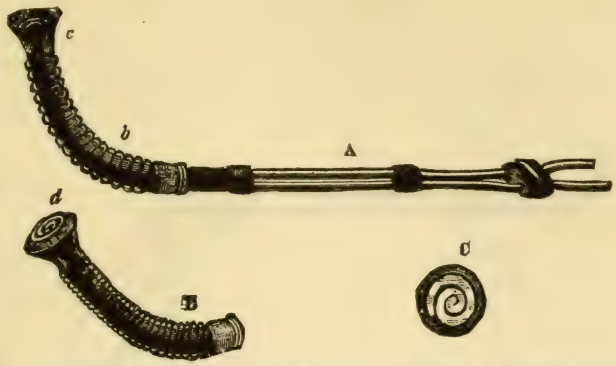

Fig. 61.—Dr. Lincoln's Post-nasal Electrode (after Beverley Robinson). A, the complete electrode, showing *b*, spiral spring, and *c*, shield. B, portion of electrode showing the disk *d* uncovered. C, disk surrounded by shield.

Post-nasal Forceps.—For removing growths from the vault of the pharynx, and from the neighborhood of the posterior nares, Löwenberg's curved forceps and my own sliding forceps are both of service. The former (Fig. 62) is an instrument with long, slender curved handles and very short blades turned upward from the rivet at an obtuse angle. The blades are scooped out on their inner surfaces, and each ends in a sharp, somewhat overhanging edge, which comes into apposition with the corresponding part of its fellow when the handles are closed. My colleague, Dr. Woakes,[1] recommends that the cutting edges should be carried farther round the blades than was the case in Löwenberg's earlier instruments.

Fig. 62.—Dr. Löwenberg's Post-nasal Forceps.

My own instrument (Fig. 63) consists of a male and a female portion. The latter is a straight cylindrical tube open on the upper aspect throughout its whole length, and ending in a sharp, spoon-shaped blade at the distal extremity; the male portion is composed of a solid shank playing backward and forward in the cylindrical part of the other limb of the instrument, and terminating in a blade of similar shape to the other, directed so that when the two are brought together the cutting edges correspond. The handle is fixed to the under surface of the proximal end of the female portion, the rivet being close to the body of the instrument, and the limbs placed one behind the other. The anterior one is fixed, and to the posterior, which can be moved backward and forward, is at-

[1] Trans. Intern. Med. Congress, London, 1881, vol. iii., pp. 295, 296.

tached a lever which traverses a slit in the anterior limb to the under surface of the cylinder, where it is fixed to a pin connected with the shank of the male portion. The opening along the top of the cylinder allows the upturned blade of the male portion to be pulled back as far as the limbs of the handle can be opened. The instrument is better adapted for the removal of growths from the *sides* of the pharynx, while Löwenberg's is more suited for operating on those on the *vault* and *posterior wall.*

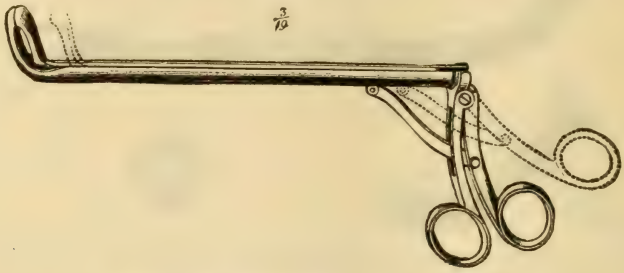

FIG. 63.—The Author's Sliding Post-nasal Forceps.

Michael,[1] of Hamburg, has invented an instrument for the removal of adenoid vegetations, which he states that he has used for the last three years. He calls it a double chisel, but it is, more strictly speaking, a cutting forceps. The blades are turned up at a right angle from the stem, the angle, however, being well rounded, and the cutting edge extending 3 ctm. beyond that point. It differs from other forceps of an analogous character in the circumstance that the principal cutting part of this instrument is at the angle and not at the point as in Löwenberg's and my own. I may add that I have not found Michael's instrument at all convenient.

In removing post-nasal vegetations, Meyer, of Copenhagen, prefers to use his own "ring-knife." This "consists, first, of a little ring of a transverse oval shape, its axes being 1.4 and 1 ctm. respectively, and its breadth 1.5 mm., having one edge sharp, although not absolutely cutting, and the other one rounded off; and secondly, of a slender, stiff,

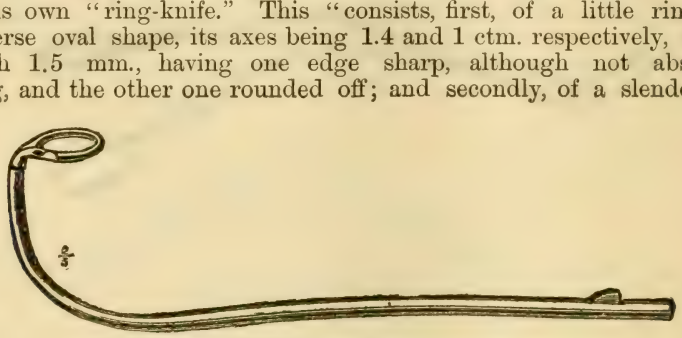

FIG. 64.—Prof. Stoerk's Post-nasal Snare.

but at the same time flexible stem 10 ctm. long, bearing the ring at one extremity, fixed into a roughened handle at the other."[2] Meyer's plan of operating is to introduce this instrument through the patient's nose into the naso-pharynx with the right hand, while the left index finger is passed into the mouth behind the velum, where it is made to press the vegetations against the edge of the ring-knife, which must at the same

[1] Berlin. klin. Wochenschrift, 1881, No. 5.
[2] Med. Chir. Trans., London, 1870, vol. liii., pp. 211, 212.

time be drawn downward, so as to scrape away the excrescence. The stem being flexible, the knife can be bent toward one side or the other, as may be necessary.

Stoerk has had a special loop (Fig. 64) adapted to his laryngeal guillotine (Fig. 48, vol. i., p. 191) for the removal of post-nasal growths. By means of this instrument I have several times taken away vegetations from the vault of the pharynx.

For the removal of small post-nasal vegetations Capart has suggested the use of a sharp spoon (Fig. 65) which can be fastened on the index finger by means of a metallic sheath composed of two rings, held together at each side by rivets, so that sufficient play is allowed for them to be moved when the finger is bent. On the palmar surface of the distal ring is the spoon. The little instrument thus serves to carry the blade, and to protect the operator's finger while it is in the patient's mouth. Many surgeons, however, prefer the natural cutting edge provided by a sharp forefinger nail.

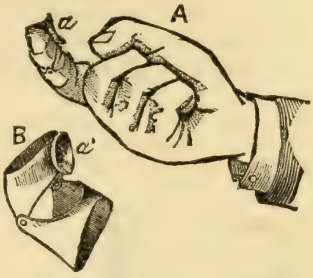

FIG. 65.—Dr. Capart's Finger Sheath with Cutting Spoon. A, the position of the hand and finger in holding the spoon; *a*, lateral view of the cutting spoon. B, enlarged view of the two parts of the metal sheath; *a'*, cutting spoon.

For the purpose of removing small sequestra of bone or other broken-

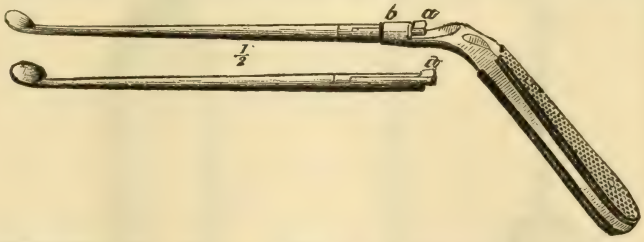

FIG. 66.—Nasal Curettes or Sharp Spoons. *a*, spring catch; *b*, articulation of the stem with the handle, which ends in a ring to receive it; the catch *a* is shown in position in the upper woodcut.

down tissue, or of "vitalizing" the borders of an indolent ulcer within the nasal cavity, Volkmann's cutting spoons are very useful. I have had

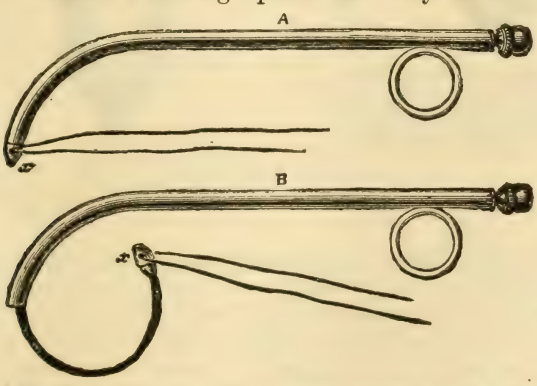

FIG. 67.—Bellocq's Sound. A, the instrument with the stylet *x* armed with a thread and ready for use. B, the same after introduction through the nares, the stylet *x* appearing at the back of the mouth.

curettes of various sizes fitted to a handle at the proper "nasal angle" (Fig. 66).

Hæmostatic Instruments.—For arresting hemorrhage from the nose, plugging the nostrils anteriorly is often found insufficient, and it then becomes necessary either to close the posterior nares, or to apply pressure within the nose. Hence there are post-nasal plugs and intra-nasal plugs.

Of the former kind of instrument Bellocq's well-known sound (Fig. 67) is the best. It consists of a piece of watch-spring, attached to a stylet contained in a canula. The watch-spring is fixed by a screw to the proximal end of the stylet, so that the point holding the string projects

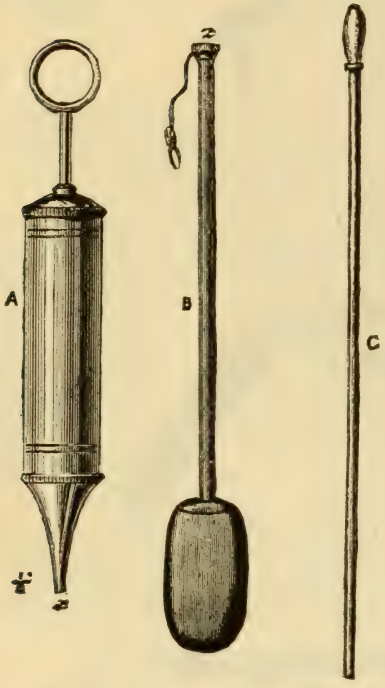

FIG. 68.—St. Ange's Rhinobyon, or Post-nasal Plug. A, syringe for injecting air or water. B, india-rubber tube or bag. C, pilot for bag. After the bag has been introduced, the point *x* of the syringe fits into the orifice *z*

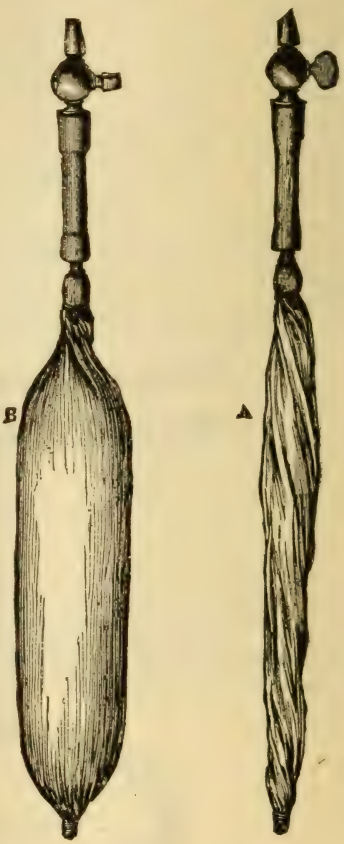

FIG. 69.—Dr. Cooper Rose's Intra-nasal Plug[1] (after Spencer Watson). A, the instrument as ready for introduction into the nose. B, the same expanded with air.

beyond the canula. After the instrument has been introduced through the nose, the screw is turned round, so that the watch-spring runs down the stylet and becomes attached to its lower end, while its free extremity projects into the pharynx near the base of the tongue, allowing the string to be readily seized with the fingers or forceps. A firm pledget of lint, sufficiently large to cover both choanæ completely, should be tied to the string, which is then drawn back through the nose and fastened round

[1] This instrument is made by Messrs. Coxeter, Grafton Street, East, London.

the ears. The string should be further secured to the face by strips of plaster. This instrument, however, is very seldom at hand when wanted, and an ordinary flexible catheter will be found quite as useful. The most efficient post-nasal plug, however, is that of St. Ange[1] (Fig. 68). This instrument, which bears the formidable name of "rhinobyon," consists of three parts, viz., a small syringe; a tube opening at its distal end into an india-rubber bag; and a small pilot sound. The pilot is introduced into the tube, and the bag is thus passed through the nose into the naso-pharynx, when the pilot is withdrawn, and the nozzle of the syringe being fitted to the mouth of the tube, air is injected and the bag distended to such an extent as to cover the choana. A little clip attached to the tube keeps it closed when the syringe is withdrawn.

Of intra-nasal plugs J. P. Frank[2] appears to have been the inventor, for he was the first to devise a special instrument (if such it can be called) to bring pressure to bear directly on the walls of the nasal fossæ. He introduced into the nose a piece of dried hog's intestine, tied at the distal end, and then injected water into the open end projecting from the nostril, tying up the gut as he withdrew the syringe. The best form of instrument, however, for this purpose, in that invented by Dr. Cooper Rose (Fig. 69). It consists of a thin india-rubber bag connected with a tube, provided with a stopcock. The bag is introduced empty into the nose and passed along the fossa, when it is inflated by blowing through

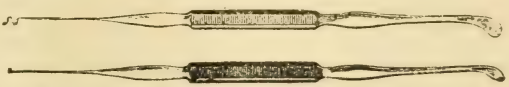

FIG. 70.—Prof. Gross' Nasal Spuds (after Solis-Cohen).

the tube. The tap should then be turned off and the instrument left *in situ* as long as may seem desirable.

Instruments for the Removal of Foreign Bodies from the Nasal Cavities.—Gross' instruments, shown in the annexed woodcut (Fig. 70), may be found useful. They consist of little scoops, corkscrew points, and hooklets. For the extraction of small nasal calculi, slender forceps (Fig. 71)

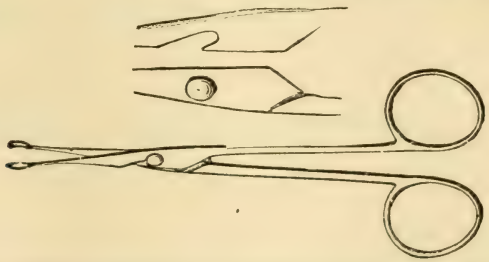

FIG. 71.—Forceps for Removing Small Foreign Bodies (after Spencer Watson).

have been recommended. The blades, which are scissor-shaped and terminate in roughened bulbous ends, articulate only after they have been

[1] Lapeyroux: Méthode pour arrêter les hémorrhagies nasales. Thèse de Paris, 1836, No. 314. In the original instrument there is a tap in the india-rubber tube instead of the little clip above mentioned. Küchenmeister subsequently invented an instrument which he called a "rhineurynter," closely resembling the one here described.

[2] De curandis hominum morbis, Mannhemii, 1807, lib. v., pars ii., p. 144.

passed separately into the nose. Instruments bent at the proper angle (Figs. 39 and 51) will, however, generally be found more convenient, as they do not obstruct the view of the operator.

Other Instruments.—For the remedy of deformities of the nose, arising from congenital deviation or badly set fracture of the septum, Adams[1] employs a pair of powerful forceps (Fig. 72), with smooth flat blades which can be easily introduced into the nasal fossæ and made to grasp the

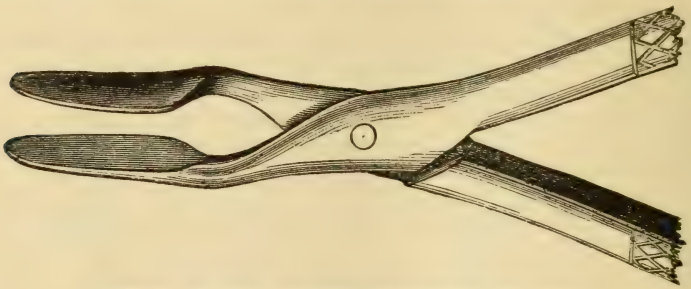

FIG. 72.—Mr. Adams' Forceps for Breaking Down the Septum.

partition between them. With this instrument it is easy either to separate the cartilaginous from the bony part of the septum, or to fracture the former, if desired. The fragments are retained in their new position by means of two little splints made either of ivory or steel, one being placed in each nostril, and the two fastened together outside with strings. These splints, however, cannot be kept in apposition without a truss to make pressure on the upper fragment, and an ingenious arrangement for this purpose has been devised by Adams.[2]

Jurasz,[3] of Heidelberg, was led to improve upon this plan on finding that the septum regained its wrong position when he withdrew the forceps, before there was time to adjust the splint. He therefore modified Adams' instrument by having the blades and shanks of the forceps separate,

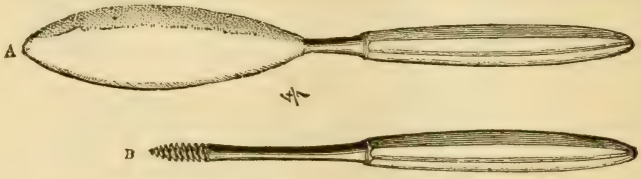

FIG. 73.—Dr. Gottstein's Cotton-wool Tampon. A, screw armed with wadding-tampon. B, the naked screw.

though screwed together. The instrument is introduced, the septum broken, the shanks unscrewed, while the blades, locked together on the principle of the ordinary midwifery forceps, remain in the nose to act as splints.

For plugging the nasal fossæ in cases of ozæna, Gottstein's cotton-wool tampon (Fig. 73) is extremely useful. All that is required is a screw about

[1] Med. Soc. Proceedings, April 26, 1875, London, 1874–75, vol. ii., pp. 99, 100.

[2] Brit. Med. Journ., 1875, vol. ii., pp. 421, 422. The instrument has been considerably modified by Mr. Adams since he first published a description of it. It is sold by Mr. Gustav Ernst, Charlotte Street, Fitzroy Square, London.

[3] Berlin. klin. Wochenschrift, 1882, No. 4.

fourteen millimetres long, terminating in a shank fixed to a handle. Round this screw a small piece of wadding is twisted. The instrument is then inserted into the nasal channel, when the screw is reversed and withdrawn, leaving the cotton-wool accurately in position.

Temporary Sponge-tampon for the Posterior Nares.—In the case of infants and very young children sprays should not be used through the anterior nares without care being first taken to prevent the fluid from

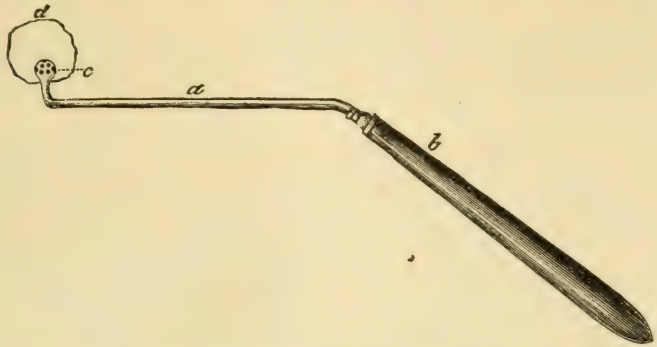

FIG. 74.—The Author's Temporary Sponge-tampon for the Posterior Nares. *a*, stem; *b*, handle; *c*, holes through which the pad can be stitched to the tip; *d*, sponge.

running through the posterior nares into the larynx. These openings should, therefore, be temporarily plugged. This can be most conveniently effected by passing a small sponge into the naso-pharnyx by means of the instrument shown in the annexed woodcut (Fig. 74). This consists of a short metallic stem fitted to a wooden handle at the proper "nasal angle," and curved upward at its distal end into a bulbous perforated point. A piece of sponge is stitched to the point of the instrument.

ACUTE NASAL CATARRH.

(SYNONYMS: CORYZA. COLD IN THE HEAD.)

Latin Eq.—Gravedo: Catarrhus narium.
French Eq.—Catarrhe nasal.
German Eq.—Schnupfen.
Italian Eq.—Corizza.

Definition.—Acute catarrhal inflammation of the Schneiderian membrane, causing sneezing, more or less obstruction of the nasal passages, and hyper-secretion of an irritating serous or sero-mucous fluid.

History.—Until the seventeenth century it was the belief of physicians that coryza was a flux of serous fluid from the cerebral ventricles, and a "cold in the head" was looked upon as a "purging of the brain." This idea prevailed till Schneider[1] gave a more correct account of the anatomy of the nose, and in particular of the function of the membrane that bears his name. Within the succeeding century several works

[1] De catarrhis. Wittenbergæ, 1664.

were published on catarrh by Wedel,[1] P. Frank,[2] Camerarius,[3] Stoll,[4] and others, but no fresh light was thrown on the subject till J. P. Frank,[5] toward the close of the last century, gave a very full account of the complaint. Several years afterward Rayer[6] published a short monograph, in which he showed how dangerous the affection is to sucklings. In the elaborate treatise on the nose by Cloquet,[7] a chapter is devoted to coryza, which is equally remarkable for antiquarian lore and practical wisdom. In 1837 Billard[8] followed up the clinical investigations of Rayer in relation to infantile catarrh. In the same year the subject was discussed by Anglada[9] at some length, but with no novelty of view as regards either the nature or the treatment of the malady. Since then the writings of Bouchut,[10] Kussmaul,[11] and Kohts[12] have elucidated the affection, especially as regards infants. Vauquelin[13] appears to have made the earliest investigations on coryza from the chemical point of view, but Donders[14] was the first to publish a detailed analysis of the secretion. Friedreich[15] made some experiments on the inoculability of the disease, and to Ranvier[16] we owe an elaborate account of coryza from the purely pathological standpoint.

Etiology.—The causes of catarrh in general have already been discussed in previous sections (vol. i., pp. 131 and 195), and only a few remarks need be made here concerning the etiology of nasal catarrh. As in most other diseases, there are *predisposing* and *exciting* causes. Among the former youth is one of the chief, children being particularly subject to coryza. The comparative immunity of the aged was recognized as far back as the time of Hippocrates.[17] Certain constitutional conditions seem to render the mucous membrane more susceptible to catarrh, and this is especially seen in the strumous diathesis. In these cases there is not unfrequently at the same time chronic enlargement of the tonsils, and sometimes catarrh of the naso-pharynx with obstruction of the Eustachian tubes. The nasal disease may be the cause or the consequence of these conditions, or, in some cases, all the phenomena may depend on a general dyscrasia. People of rheumatic constitution, and those in whom the sweat-glands act feebly, are also prone to nasal catarrh. Alibert[18] maintains that persons of decidedly nervous temperament are especially liable to the complaint, and he states that he has seen extremely acute forms of nasal catarrh, with very profuse secretion, occur in women after convulsions. Asthmatic people are particularly liable to the affection, and hay fever may be regarded as a connecting link between these two disorders.

Exposure to cold, under certain circumstances, is very apt to cause catarrh, but the exact mode of its operation is uncertain. Cold currents of air on the head are familiarly recognized as a cause of the disorder, and the bald are in this respect, of course, peculiarly vulnerable. Cloquet[19]

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[1] Casus laborantis coryza. Jenæ, 1673.
[2] Dissert. de coryzâ. Heidelberg, 1689.
[3] De coryzâ, 1689.
[4] Ratio Medendi, t. iii., p. 44.
[5] De curand. homin. morbis, Mannhemii, 1794, lib. v., p. 102 et seq.
[6] Sur le Coryza des Enfants à la Mamelle. Paris, 1820.
[7] Osphrésiologie. Paris, 1821.
[8] Maladies des Nouveau-nés, Paris, 1837, 3me ed., p. 502 et seq.
[9] Sur le Coryza simple, Thèse de Paris, 1837.
[10] Traité pratique des Maladies des Nouveau-nés. Paris, 1867.
[11] Zeitschrift für rationelle Medicin, 1865.
[12] Krankheiten d. Nase, in Gerhardt's Handbuch d. Kinderkrankheiten, Dritter Bd., Zweite Hälfte. Tübingen, 1878.
[13] Quoted by Anglada. Op. cit., p. 16.
[14] Nederlandsch. Lancet, 1849–50, 2. series, v., p. 312.
[15] Virchow's Handb. d. Pathol. und Therapie, Erlangen, 1865, Bd. v., Abtheil I., p. 398.
[16] Soc. de Biologie de Paris. Summary in Lancet, 1874, vol. i., p. 687.
[17] Aphorism, Paris, 1844, ii., 40, Littré's edition, t. iv., p. 483.
[18] Obs. sur les Affections Catarrhales en Général. Paris, 1813.
[19] Op. cit., p. 602.

was of opinion that the frequent occurrence of coryza after getting the feet wet or cold, was to be explained by some special sympathy between the feet and the pituitary membrane, a connection which he attempts to support by an isolated case, in which nasal catarrh was always a concomitant of gout in the toe.[1] The truth seems to be that catarrh so frequently results from wet feet, simply because those extremities are exposed to wet and cold more often, and for longer periods than any other covered portion of the body.

The influence of heat in producing catarrh is less generally recognized, and its mode of action is very imperfectly understood. Its effects are seen under two conditions: First, where the disease results from exposure to the sun; secondly, where it follows confinement in hot rooms. The catarrhal symptoms, arising from exposure to the sun, may be due to direct irritation by the solar rays, or it may be of reflex character, *i.e.*, dependent upon the impression on the retina. Coryza resulting from confinement in a hot room is generally observed in persons of enervated constitution, whose mucous membrane has been relaxed by previous attacks.

The influence of irritating vapors, or solid particles suspended in the air, in producing inflammation of the pituitary membrane, will be considered under Traumatic Rhinitis, and the effects of the pollen of certain grasses will be treated of under Hay Fever. In connection with the action of local irritants, it may be observed that the sensibility of the nasal mucous membrane becomes blunted in the case of the habitual snuff-taker, in whom also the liability to catarrh is diminished.[2]

Occasionally coryza appears to be due to epidemic influences, and several persons in the same house, the dwellers in a particular street, or even the inhabitants of a whole town, may be observed to suffer simultaneously. The supposed epidemic described by Anglada,[3] in which an entire army became suddenly affected with catarrh, is, however, probably, only an illustration of the ordinary mode in which cold is caught. The French troops, after spending the greater part of a very hot and dry summer in Andalusia, were caught in a violent storm after a long and fatiguing march. This was immediately followed by an almost universal catarrh.[4] In short, coryza can only be said to occur epidemically in so far as a sudden lowering in the temperature, with increased humidity of the air, may cause the malady to be widespread.

Although there is a belief among the laity that a cold can be "caught" from a person laboring under the disorder, there is no evidence that coryza is infectious, and it is very doubtful whether it is ever spread by contagion. Immediate contact,[5] especially in kissing, is, however, thought by many to

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[1] Compare Stoll: Ratio Medendi, v., p. 436.

[2] Plugging the nose with tobacco was formerly thought a good protective against "catching cold." Sir William Temple is said to have kept a leaf of tobacco up each nostril for an hour every morning, in order to drain the secretion from the eyes and head. In this way he fancied that his sight was preserved, at the same time that liability to coryza was diminished. (Sigmond: Lectures on Materia Medica at Windmill Street.) Lancet, 1836–37, vol. ii., p. 157.

[3] Op. cit., p. 16.

[4] Cloquet has alluded to an epidemic of coryza among dogs (Stoll: Ratio Medendi, t. iii., p. 44), and his observations have been repeatedly quoted by subsequent writers. On referring to the original text of Stoll, however, it is clear that the epidemic was one of distemper: "tussis laboriosa, spontaneæ vomitiones, putrilago vomitibus refusa, extrema macies, et tandem veluti quorundam artuum semi-paralysis, et mors."

[5] The belief in the contagious nature of coryza appears to have existed for several centuries. Thus, more than two hundred and seventy years ago Crato spoke of "coryzæ halitu etiam contagiosæ. Id cum vulgus in Germaniâ sciat, non facile ex eodem poculo, e quo coryzâ laborans potum hausit, bibit" (Johannes Crato in Epist. Philosoph. Med., Hanoviæ., MDCX., Ep. cvi., p. 188).

be a common mode of spreading the disease. Fränkel [1] states that he has seen several cases which appeared to originate in this way. But the only attempt at direct inoculation with which I am acquainted is that of Friedreich,[2] who endeavored to generate the disorder in his own person, by applying the secretion taken from persons in various stages of coryza to his nasal mucous membrane. The results of this experiment, however, were entirely negative.

The suppression of habitual discharges is sometimes followed by the development of coryza. Cloquet [3] mentions that the disorder may follow the cure of chronic ophthalmia, the stoppage of bleeding from piles, the cessation of the menstrual flow, or even the disappearance of a rash. I have myself frequently noticed an increased susceptibility to nasal catarrh in delicate women during or immediately after the catamenial period, but I am inclined to consider the occurrence of catarrh under these circumstances to be due to the temporarily lowered vitality which affects the whole system. I have also several times seen coryza follow the cure of chronic otitis.

Nasal catarrh frequently complicates the exanthemata, especially measles, small-pox, scarlatina, and typhus; it also accompanies facial erysipelas, and it is nearly always one of the earliest and most marked symptoms of influenza.[4] In measles there can be little doubt that the congested appearance of the nasal mucous membrane is, in fact, the eruption itself, while in scarlatina the coryza seems usually to be caused by an extension of the inflammatory process from the throat. In typhus, the pituitary membrane merely shares in the general catarrhal affection of the mucous tracts.

Nasal catarrh, as a symptom of iodism, is a familiar fact of medical experience.[5]

Symptoms.—A cold in the head is of such every-day occurrence that a very brief description of the symptoms will suffice. Like other disorders of an inflammatory nature, the first indications are those of pyrexia, viz., lassitude, chilliness, and occasionally, but very rarely, a slight rigor. The first sensation, however, which points distinctly to the nature of the attack, is a feeling of fulness and sometimes of throbbing or pain in the frontal region, and this symptom is soon succeeded by paroxysms of sneezing of greater or less severity. In a short time the nares become blocked up from swelling of the mucous membrane, and after a few hours the characteristic state of hyper-secretion is established. The local phenomena relating to the discharge from the nasal mucous membrane are seen in four stages: The lining membrane of the nose is first slightly swollen, then an abundant irritating *watery* secretion takes place, afterward this becomes

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[1] Ziemssen's Cyclopædia, vol. iv., p. 117. [2] Loc. cit.

[3] Op. cit., p. 602.

[4] At the commencement of nasal diphtheria, coryza is occasionally present, but, as has been already remarked (vol. i., p. 128), the actual membrane nearly always forms first in the pharynx, and from thence extends into the nares.

[5] In accordance with the germ theory so much in vogue at the present day, it has been suggested that nasal catarrh may be caused by a specific germ. Indeed, Salisbury (Haller's Zeitschrift, Jena, January, 1873, p. 7) has described and figured this germ under the name of *Asthmatos Ciliaris*. It has also been seen by Ephraim Cutter and P. F. Reinsch (Virginia Med. Monthly, November, 1878), and, on one occasion, by Daykin, a pupil of Salisbury, who remarks that he had "had a nice time looking at the animal" (see Coomes: Pharyngeal Catarrh, Louisville, 1880, p. 134). Notwithstanding this confirmation, minute organisms are so common even in healthy secretions that further observations are necessary before the view can be accepted.

thick and muco-purulent and loses its irritating quality, and finally the discharge gets thin again, without recovering its irritating properties, and gradually ceases altogether. The time occupied by these various stages differs, some catarrhs passing off in three or four days, while others last as many weeks. The duration of the attack principally depends on the length of time which the third and fourth stages occupy; for the dryness of the mucous membrane rarely continues more than a few hours, and the abundant irritating secretion seldom causes trouble for more than one or two days.

The watery fluid of the second stage is decidedly saline, and from its irritating quality it often causes excoriation of the skin about the margin of the nostrils. Together with these symptoms there is usually more or less impairment of the sense of smell. When the *anterior* nares are completely obstructed, the voice has a nasal twang in all its tones, while when the stoppage is confined to the *posterior* nares, the general character of the voice is normal, but the articulation is defective, *m* becoming *b*, and *n* being sounded as *d*. Of course, if the obstruction affects the whole nasal passage, both the general and the special defects are present. These points have been explained in connection with post-nasal growths by Löwenberg;[1] and Seiler[2] has recently shown that the peculiar tone of the voice caused by obstruction of the anterior nares is due to the fact that the nasal cavities can no longer act as a reverberating chamber, while post-nasal obstruction simply interferes with that free passage of air which is necessary for the articulation of the letters *m* and *n*.

The course of a simple attack of acute nasal catarrh just described in detail is, however, often arrested or modified, and almost any of the symptoms, except the discharge, may be entirely absent.

On the other hand, when the bony cavities communicating with the nose are involved in the catarrhal process, the symptoms are sometimes more troublesome. If the antrum of Highmore becomes affected, there will be severe pain in the cheek, while extension to the frontal sinuses causes a dull pain in the forehead, and if the ethmoidal and sphenoidal cells become implicated, the headache becomes intensified. Ringing in the ears and deafness point to temporary blocking up of the Eustachian tube, and the occurrence of epiphora shows that the lachrymal duct is obstructed. Slight but painful abrasion of the nasal mucous membrane near the margin of the nostrils and herpes labialis are often troublesome concomitants. In infants coryza sometimes produces such dangerous symptoms that it will be more convenient to deal with them separately (see p. 204).

Diagnosis.—An ordinary catarrh can scarcely be mistaken for any other affection, but it must be remembered that it is sometimes a premonitory symptom of some acute specific disease, and when there is much conjunctival inflammation the likelihood of the development of measles should be borne in mind. Still more rarely nasal catarrh may simulate disease of the bones. Thus, Peter[3] relates a case in which there was such severe pain in the brow at the outset that the complaint was regarded as one of "acute caries" of the frontal bone, but on the application of a poultice to the root of the nose a profuse discharge was established, which almost instantly relieved the pain and proved the case to be one of coryza.

[1] Tumeurs adénoïdes du Pharynx nasal, Paris, 1879, p. 26.

[2] Archives of Laryngology, January, 1882, vol. iii., No. 1, p. 24.

[3] Quoted in the article on "Coryza" in the Dict. Encyclop. des Sci. Méd., Paris, 1878, t. xxi, p. 3.

Prognosis.—In the great majority of cases complete recovery takes place, and it is only in old people and very young children that coryza is attended with any danger; but it may terminate in chronic catarrh with much thickening of the mucous membrane, or it may lead to the development of polypi.

Pathology.—The process is essentially one of active congestion of the pituitary membrane followed by serous exudation. The fluid is stated by Cornil and Ranvier [1] to contain lymph-corpuscles from the outset, and epithelial cells are found in increasing numbers as the catarrhal condition advances, the discharge being thus rendered at first cloudy and afterward opaque. The mucous membrane is red and tumid, and numerous small tortuous vessels are often visible; while here and there dark brown stains, caused probably by submucous ecchymosis, may sometimes be seen with occasional abrasion or slight ulceration of the mucous membrane.

Treatment.—Though from an early period it has been a constant reproach to medical practitioners that they are unable to cure a "common cold," the blame really rests with the patient more than the physician. For, as a rule, persons suffering from catarrh feel so little inconvenience that they are unwilling to submit to the restraint and regimen which are necessary to insure rapid recovery. The disorder may be treated by *stimulants*, by *derivatives*, or by one of the many remedies, the action of which is too obscure to permit of classification. Of all stimulants opium is the most trustworthy. The older physicians recognized its value in stopping a catarrh, and generally gave it in the form of Dover's powder at bedtime, but the effect of the drug is much greater if administered in small doses during the day. Laudanum is better than any other preparation, and five or seven drops taken at the commencement of an attack will often cure it at once. The remedy acts more quickly and more certainly if taken on an empty stomach, and if one dose is not sufficient it may be repeated twice in the day at intervals of six or eight hours. If at the end of two days the catarrh still persists it is useless to try to cut it short. Opium may also be administered in the form of a snuff containing morphia and bismuth as first recommended by Ferrier [2] (see Appendix). The patient ought to commence taking the snuff as soon as the symptoms of coryza begin to show themselves, and at first it should be employed frequently so as to keep the interior of the nostrils well coated. Each time the nose is cleared another pinch should be taken. This powder may also be administered by blowing it into the nasal cavities with Bryant's auto-insufflator. (Fig. 37, p. 177).

Camphor has long been held in high esteem by the public as a "certain cure" for incipient catarrh, and many persons find that ten drops of spirits of camphor taken on a piece of sugar at once arrests a cold.

Instead of employing medicines which control secretion by acting through the nervous system, local stimulants may be prescribed in the form of inhalations. In Germany a preparation known as Hager-Brand's "Anti-catarrhal Remedy," [3] and consisting of ammonia and carbolic acid, is largely used as a household remedy (see Appendix). The vapor of a few drops of this nostrum, poured into a small cone of blotting-paper, should be inhaled till the liquid is evaporated, and this may be done every two or three hours until relief is obtained, or the inefficacy of the remedy proved.

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[1] Manuel d'Histologie pathol., Paris, 1869, pp. 653, 654.
[2] Lancet, April 8, 1876.
[3] Wien. med. Wochenschrift, June 5, 1872.

"Alkaram," so extensively advertised in England, appears to contain the same ingredients. I have often seen great benefit result from smelling strong ammonia salts without the addition of carbolic acid. These "olfactories" should only be employed at the moment when a disposition to sneeze is felt, for at other times they will often increase the catarrh by provoking an attack of sneezing. In some persons the inhalation of iodine vapor acts favorably, and will cut short a catarrh in a few hours. "The inhalation of chloroform to the induction of anæsthesia administered after the patient has been put to bed will often be found adequate," says Solis-Cohen,[1] "to abort a cold by its relaxing influence upon the structures which are in a state of tension." Although I do not in the least doubt the efficacy of this plan, it is obviously too risky to be adopted, unless under very exceptional circumstances.

Derivative treatment may be carried out by the administration of diaphoretics, diuretics, or purgatives. James' powder, of which the pulvis antimonialis of the British Pharmacopœia is an imitation, was once a very popular remedy in England. If used, two grains should be given every three or four hours until diaphoresis is established. A mixture, consisting of five grains of nitrate of potash, twenty drops of spiritus ætheris nitrosi, and two drachms of liquor ammonia acetatis is a time-honored remedy. If such medicaments are administered the patient should at the same time use the familiar adjuvant of a hot foot-bath. It need scarcely be added that if this form of treatment be adopted the patient should be confined to the house, or even kept in bed. His diet should be light, and alcoholic stimulants should be avoided, the only exception being a glass of hot spirits and water at bed-time. Diaphoresis may be carried out in a more energetic way by means of Turkish baths, a method which has the advantage of not preventing the patient from pursuing his ordinary avocations.

The late Addington Symonds, of Clifton, widely known as a most accomplished and experienced physician, strongly recommended[2] the following pill and draught as a means of preventing nasal catarrh from running into bronchitis: ℞. Extr. hyoscyami, pulv. conii, āā. gr. iv.; calomel, pulv. ipecac., āā. gr. j. M. ft. pil. ii. vespere sumendæ. This was followed by a draught in the morning consisting of Rochelle salts (tartrate of soda) and senna, and the patient was kept in bed half the following day.

Small doses of aconite have been recommended for catarrh, but I have frequently tried this remedy in cases where the coryza was accompanied by high temperature, and have never been able to satisfy myself that it produced any appreciable effect in cutting short an attack.

In conclusion it may be mentioned that total abstinence from liquids, as was pointed out by Richard Lower,[3] and more recently by C. J. B. Williams[4] will generally quickly check catarrh. The coryza begins to diminish in about twelve hours, and a cure is usually effected in two days. Williams allows, without recommending, a tablespoonful of milk or tea twice in the day, and a wineglass of water at bedtime. The system should be put in force at the very outset of a catarrh.

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[1] Diseases of the Throat and Nasal Passages, New York, 1879, second edition, p. 336

[2] Ranking's Abstracts, vol. i., p. 55.

[3] Dissert. de Origine Catarrhi, ed. quinta, Lugduni Batavorum, 1708, cap. vi., p. 258.

[4] Cyclopædia of Pract. Med., London, 1833, vol. i., p. 484.

ACUTE CORYZA IN INFANTS.

It is a matter of familiar observation that the nose is relatively smaller than the other features in newly-born children, but it is only recently that the peculiar anatomical condition of the nasal fossæ in infants has been distinctly described. To Kohts and Lorent [1] we are indebted for showing that in these young subjects the meatuses are exceedingly narrow, the free extremity of the inferior turbinated bone being, as compared with that in the adult, longer and curved further round, so that scarcely any room is left for a passage at all. The relative smallness of the passages, however, is most marked in the middle meatus, its direction being quite horizontal, and its anterior orifice being only an exceedingly minute circular opening. During adolescence this round aperture enlarges anteriorly and at the upper part, resulting in a kind of crook-shaped curve, which greatly increases its size. Now it appears from the observations of Kussmaul [2] that the mouth in newly-born children is almost always closed during sleep, that the tongue is brought into contact with the hard palate, and that thus, even in those rare cases where the lips are open, no air passes through the mouth. Bearing in mind the anatomical conditions of the nose in infants which have just been described, it can easily be understood that a very slight swelling of the pituitary membrane is likely to be attended with considerable difficulty in breathing, a circumstance which J. P. Frank [3] was the first to recognize. No sooner does the child suffering from severe catarrh fall asleep than it is apt to be attacked by a paroxysm of dyspnœa, and the attempts to inspire under these circumstances may lead to extreme pulmonary engorgement. The difficulty of breathing is, according to Bouchut,[4] sometimes greatly intensified by the tongue being drawn down and blocking up the laryngeal orifice in the same manner as it does occasionally under the influence of an anæsthetic. These attacks frequently resemble laryngismus stridulus, or may even be mistaken for laryngitis. But there is another danger, viz., that of starvation, for the child may be unable to suck without risk of suffocation on account of the obstructed state of its nasal passages. Although, however, infants are liable to these perils it must be admitted that they are very rarely encountered in practice.

Most of the remedies recommended for adults may be used in reduced doses, but opiates should never be administered. A small open tube put through the nose will sometimes enable the child to suck easily ; but should this plan not answer, the infant must be taken from the breast and fed with its mother's milk by means of a spoon, and as a last resource a short œsophageal tube (Fig. 11, p. 17) must be used.

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[1] Handb. d. Kinderkrankheiten, von Prof. Gerhardt, 1878, Dritter Band, Zweite Hälfte, p. 4 et seq.

[2] Zeitschrift f. rationelle Medicin, 1865, p. 225.

[3] De curandis hominum morbis, Mannhemii, 1794, lib. v., pars i., p. 107.

[4] Quoted by Fränkel, Ziemssen's Cyclopædia, vol. iv., p. 106. On this interesting subject see also Henoch (Beiträge z. Kinderheilk., Berlin, 1868, p. 124) and Hauner (Jahrb. f. Kinderheilk., 1862, vol. v., p. 73).

PURULENT NASAL CATARRH.

Purulent inflammation of the nasal mucous membrane, in exceedingly rare cases, may be simply an aggravation of an ordinary acute catarrh. It may likewise result from injuries or from the prolonged presence of foreign bodies; but in this article it will be briefly referred to as an acute affection in which the formation of pus is the distinguishing feature from the outset. Purulent nasal catarrh may be met with both in newly-born children and in adults. In the former case it is generally thought that the inflammation results from infection of the mucous membrane of the nose with the leucorrhœal discharge which frequently occurs in the last months of pregnancy, or in some still rarer instances from gonorrhœa, from which the mother may have been suffering at the time of parturition. It is extremely doubtful, however, whether such catarrhs are really the result of maternal infection—the sudden exposure at birth of the delicate mucous membrane to the irritating influence of the atmosphere, or the entrance of soap into the nostrils in careless washing, being sufficient to account for the occasional occurrence of the complaint. It may be added that the influence of vaginal discharges upon the mucous membrane of the eyes and nose of infants in the act of birth has yet to be investigated on a large scale. If sufficient statistical evidence can be obtained to show that the children of women suffering from such discharges are often affected with purulent ophthalmia or rhinitis, while the infants of women free from leucorrhœa show no signs of such inflammations, the question will be settled. At present the weight of opinion is no doubt in favor of the theory of contagion at the time of birth; but this view rests more on *a priori* grounds than on statistical evidence. Hermann Weber,[1] however, has reported a case in which it is probable that direct contagion occurred. The mother had suffered during the last weeks of gestation from an abundant yellowish discharge from the vagina, and the child, *which had not been washed for three hours after birth*, was subsequently attacked with purulent inflammation of the left eye and of the nostrils, the nose being swollen and stuffed up with crusts. The nasal discharge varied somewhat in character, being sometimes watery, sometimes thick and yellow, and sometimes mingled with blood.

There are very few cases on record in which purulent nasal catarrh has resulted from gonorrhœal infection in adults. The only instances which I have been able to find in medical literature are the three following: Boerhaave[2] relates that a patient of his own, after squeezing some matter out of his urethra for the inspection of the surgeon, thoughtlessly put his fingers immediately afterward into his nose. Very severe rhinitis ensued, followed by extensive ulceration. Another case is related by Edwards[3] in which an elderly woman consulted him for inflammation of the nose with purulent discharge which had excoriated the upper lip. The patient suffered so much pain and was so emaciated and ill that the disease was suspected to be malignant ulceration of the nasal cavity. Edwards, however, on inquiring into the history of the case, ascertained that about six months previously the woman had wiped her nose with a handkerchief which had been employed as a suspensory bandage by her son, who was suffering

[1] Med.-Chir. Trans., 1847, vol. xliii., p. 177.
[2] Tractatio med. pract. de lue venereâ, Lugd. Batavorum, 1751, p. 41.
[3] Lancet, April 4, 1857.

from gonorrhœa at the time. Five days after this occurrence the patient's nose became violently inflamed. She was treated with iron and quinine internally, and the nasal fossæ were washed out with tepid water, after which a mildly detergent lotion was used. Edwards, in commenting on the case, affirms that he has known several instances where patients suffering from gonorrhœa had infected their own nostrils by carelessly touching them with their fingers, but this was the first case in his experience in which another individual had been so inoculated.[1] A revolting example of direct infection of the nasal mucous membrane has been reported by Sigmund,[2] in which a man contracted purulent rhinitis from introducing his nose into the vagina of a prostitute suffering from gonorrhœa.

An attack of purulent inflammation of the nose is usually ushered in by some degree of systemic disorder such as shivering and general febrile symptoms. In Edwards' case, quoted above, these were very severe. Excoriation and ulceration are almost always produced by the discharge, especially at the edges of the nostrils, and on the upper lip. The inflammatory process is also apt to invade the eyes, if indeed the conjunctiva is not simultaneously infected. In infants the nose may be so plugged up by thickened secretion that respiration by that channel is rendered impossible, and thus the troublesome consequences described in the last article are likely to follow.

The *treatment* should consist in cleansing the parts with a tepid alkaline spray or collunarium (see Appendix). Afterward the nasal cavities should be syringed out with some mildly astringent injection such as alum (gr. v. ad ℥ j.), sulphate of zinc (gr. ij. ad ℥ j.), sulphate of copper (gr. ij. ad ℥ j.), or nitrate of silver (gr. j. ad ℥ j.). In the case of infants the injections into the nose often give rise to violent attacks of coughing, owing to some of the fluid getting into the larynx. Under these circumstances it will be found convenient to use the Temporary Sponge-tampon (p. 197) while douching or syringing is being carried out. Where there is difficulty of sucking from stoppage of the nose, the little patient should be fed in the manner recommended under Acute Coryza in Infants (p. 204).

Traumatic Rhinitis.

Irritating vapors, or solid particles suspended in the atmosphere, frequently produce catarrh, and no doubt many otherwise inexplicable cases of coryza are due to this cause. It can be readily understood that the vapors of chlorine, ammonia, and iodine are extremely likely to set up irritation of the nasal mucous membrane. The influence of more palpable irritants is seen in the case of millers, ivory-turners, sawyers, brush-makers, and persons engaged in kindred employments. It is remarkable, however, that the nasal mucous membrane does not generally seem to suffer in the same way as the pharynx from exposure to hot steam or smoke (vol. i., p. 75).

In addition to casual sources of irritation there are certain substances which when present in the atmosphere, produce a specific effect on the lining membrane of the nose, and among these bichromate of potash,

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[1] Chelius (System of Surgery, Eng. Trans., London, 1847, vol. i., p. 177) mentions purulent rhinitis as an occasional *concomitant* of gonorrhœa, and his translator, South (Ibid., note to paragraph 168), quotes two examples of such an occurrence from Benjamin Bell.

[2] Wien. med. Wochenschrift, 1852, p. 572.

arsenic, and mercury may be particularly mentioned; while osmic acid is stated by Seiler[1] to be an irritant of such strength as to be capable of producing coryza within one or two hours. Attention was first drawn to the influence of bichromate of potash by Bécourt and Chevallier,[2] who noticed that certain effects were produced on the workmen exposed to the steam from the boilers in which that substance is made. The subject was afterward taken up and investigated by Delpech and Hillairet,[3] who found that similar effects were produced on persons exposed to the dust of the yellow chromate, although they were manifested less rapidly and in a much slighter degree than in the case of the bichromate vapor.

The first *symptoms* produced by the bichromate are a tickling sensation in the nose, violent sneezing, and an abundant discharge, which at the commencement is watery in character, but soon becomes thick and green. At a later period the discharge contains crusts, and even flakes of sloughing mucous membrane, but it is never offensive. Epistaxis not unfrequently occurs, and ultimately portions of cartilage are expelled. Perforation always takes place at a level of one and a half, or at most two centimetres above the lower edge of the septum. At first the aperture is round and very small, but as it increases in area is becomes oval in shape. It may thus extend to the junction of the cartilage with the vomer and the perpendicular plate of the ethmoid. As the lower and anterior part of the cartilage always remains intact, the bridge of the nose never falls in. Ulcers occasionally form on the turbinated bodies, but they are not nearly so severe as on the septum.

Casabianca[4] points out that the reason why the septum particularly suffers is that, owing to the shape of the nostrils, the columns of inspired air, on entering the nose, first strike against that part; while the mucous membrane in that situation being much less rich in glandulæ than that of the external wall, is not so well protected by secretion. The rapidity with which perforation occurs is due to the thinness of the mucous covering, which leads to its speedy destruction by ulceration, coupled with the fact that the cartilage itself receives its vascular supply solely from this source, and therefore necessarily loses its vitality as soon as the membrane is destroyed.

Snuff-takers seem to be exempt from the disease, and those who have once suffered from it afterward enjoy immunity from common catarrh.

Delpech and Hillairet[5] have reported four cases of an analogous nature, in which perforation of the septum occurred in individuals exposed to arsenical dust, principally those who worked with "Schweinfurth green." The same thing has been noticed among makers of artificial flowers and wall-papers. Ulcerations of the nasal mucous membrane have also been observed[6] among those who use bichloride of mercury in dyeing feathers and silvering mirrors.

The poisonous effect of these materials in such cases is no doubt purely local, and is not the result of constitutional absorption.

All persons employed in trades which cause the nasal mucous membrane to be exposed to deleterious matters should wear plugs of cotton-wool in their nostrils. Although when perforation has once taken place it

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[1] Diseases of the Throat, Philadelphia, 1883, second edition, p. 204.
[2] Annales d'Hygiène, Juillet, 1863, t. xx., p. 83.
[3] Ibid., 1869, t. xxxi.
[4] Des Affections de la Cloison des Fosses nasales, Paris, 1876, p. 42.
[5] Loc. cit.
[6] Casabianca: Op. cit.

is difficult to prevent the formation of a tolerably large hole in the septum, the morbid action is strictly confined to a small area, beyond which its ravages never extend. The use of simple sprays will soon restore the surrounding mucous membrane to a fairly healthy condition.

HAY FEVER.

(Synonyms: Hay Asthma. Summer Catarrh. Rose Catarrh.)

Latin Eq.—Catarrhus æstivus.
French Eq.—Catarrhe d'été. Catarrhe de foin.
German Eq.—Frühsommer-Catarrh. Heu-Asthma.
Italian Eq.—Asma dei mietitori.

Definition.—A peculiar affection of the mucous membrane of the nose, eyes, and air-passages, giving rise to catarrh and asthma, almost invariably caused by the action of the pollen of grasses and flowers, and therefore prevalent only when they are in blossom.

History.—The first detailed account of hay fever was given by Bostock,[1] who, 1819, described a "periodical affection of the eyes and chest," from which he was himself a sufferer. In 1828[2] this physician published some further observations of the complaint, under the name of "summer catarrh." A short paper on hay asthma, by Gordon,[3] appeared in 1829, and in 1831 Elliotson[4] gave a brief description of the complaint. A few years later the same physician[5] discussed the subject more fully, and with characteristic sagacity pointed to pollen as the probable cause of the affection.

A systematic inquiry into all the circumstances of the disease was made in 1862 by Phœbus,[6] of Giessen, whose own personal observation of the disease was, however, confined to a single case. Unlike most of the other writers upon the subject, moreover, he did not himself suffer from the complaint. His method consisted in issuing circulars and advertisements inviting medical men all over the world to send him answers to a series of questions so framed as to embrace every possible kind of information about the causes, symptoms, and progress of the disorder; its periods of prevalence, geographical and ethnological distribution; and its prevention and treatment. In this manner a vast quantity of facts and observations was collected, and from these Phœbus endeavored to extract a complete theory of the disease. During the ensuing ten years pamphlets on hay fever were published by Abbott Smith,[7] Firrie,[8] and Moore,[9] dealing with the disorder from various points of view, but all, more or less, showing a disposition to limit the cause of its development to emanations from plants.

In 1869 a theory of hay fever was propounded by Helmholtz,[10] who was himself a sufferer from the complaint. He held that the symptoms were produced by vibrios, which, although existing in the nasal fossæ and sinuses at other times, were excited to activity by summer heat. He professed to have found a ready means of relief and even of prevention in the injection of quinine, which Binz had shortly before shown to be poisonous to infusoria. Subsequent experience has not confirmed Helmholtz's conclusions. In the following year a short practical paper was published by Roberts,[11] in which he claimed to have been the first to observe that excessive coldness of the tip of

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[1] Med.-Chir. Trans., London, 1819, vol. x., pt. i., p. 161 et seq.
[2] Ibid., vol. xiv., pt. ii., p. 437 et seq.
[3] London Med. Gazette, 1829, vol. iv., p. 266.
[4] Ibid., 1831, vol. viii., p. 411 et seq.
[5] Lectures on the Theory and Practice of Medicine, London, 1839, pp. 516–527.
[6] Der typische Frühsommer-Katarrh. Giessen, 1862.
[7] Observations on Hay Fever. London, 1865, second edition.
[8] Hay Asthma, London, 1867.
[9] Hay Fever. London, 1869.
[10] Binz: Virchow's Archiv, February, 1869.
[11] New York Med. Gaz., October 8, 1870.

the nose is "*the* pathognomonic" symptom of hay fever, and desired to have due credit awarded for the discovery. In 1872 Morrill Wyman[1] discussed the disease as it prevails in America, and tried to establish that two distinct forms of the complaint exist in that country—one occurring in May and June, and corresponding to English hay fever, and a later variety peculiar to America, which he called "Autumnal Catarrh." In 1873 Blackley,[2] of Manchester, published a work which is a model of scientific investigation. By a most ingenious and carefully conducted series of experiments he proved that in his own person at least the pollen of grasses and flowers was the sole cause of hay fever, and that in the case of two other patients the severity of the disease bore a direct relation to the amount of pollen in the air. His subsequent observations made it extremely probable, indeed almost certain that, though transient irritation of the mucous membrane may occasionally be caused by simple dust, pollen is in fact the true *materies morbi* of summer catarrh. In 1876 a short treatise was published by Beard,[3] of New York, in which he dealt with the complaint as it is met with in the United States. His information was collected chiefly by circulars after the manner of Phœbus, but more fortunate than that observer, Beard had himself seen and treated many cases. He received replies from over two hundred patients, and on these data he came to the conclusion that the immediate exciting causes are more than thirty in number, and that further investigations may extend the number of secondary causes to fifty or even a hundred. Beard showed clearly from his statistics that a large proportion of the sufferers are of nervous temperament, and that nerve-tonics are of considerable value in the treatment of the affection. In 1877 an essay was published by Marsh,[4] in which he completely accepts the pollen theory. The influence of a morbid condition of the nasal mucous membrane in favoring the development of hay fever has been recently insisted on by Daly,[5] Roe,[6] and Hack.[7]

Etiology.—In accordance with the usual method, the causes of hay fever may be conveniently divided into (*a*) predisposing and (*b*) exciting.

a. The predisposing cause of the complaint is the possession of peculiar idiosyncrasy, but on what that idiosyncrasy[8] depends is quite unknown. Whether it is due to some local abnormality affecting the structure of the mucous membrane, the capillaries, or the periphery of the nerves, but of too delicate a nature to admit of detection by available methods of research, cannot be determined. The fact, however, remains, that while millions of people are exposed to the cause of the affection very few suffer from it. The idiosyncrasy is generally suddenly developed without apparent reason. Once acquired, however, it is seldom lost, the predisposition seeming rather to increase with each recurring summer. The circumstances which are supposed to influence this idiosyncrasy are *race*, *temperament*, *occupation*, *education*, *mode of life*, *sex*, *heredity*, and *age*. These various points may, with advantage, be considered in detail.

The influence of *race* is seen in the fact that it is the English and Americans who are almost the only sufferers from the complaint. In the

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[1] Autumnal Catarrh. New York, 1872.

[2] Hay Fever. London, 1873, and second edition, 1880.

[3] Hay Fever; or, Summer Catarrh. New York, 1876.

[4] Hay Fever; or, Pollen-poisoning. Read before the New Jersey Medical Society, 1877.

[5] Archives of Laryngology, 1882, vol. iii., p. 157.

[6] New York Med. Journ., May 12, 1883.

[7] Wien med. Wochenschrift, 1882–83.

[8] In this respect the idiosyncrasy is like idiosyncrasies in general. The existence of these personal peculiarities is too well known to require much comment. Many people cannot eat crabs, lobsters, or strawberries without being attacked with urticaria. Others, again, cannot eat mutton or white of egg without being sick. One of the most interesting cases of idiosyncrasy, and peculiarly appropriate to the present subject, inasmuch as it was brought into operation through the nasal mucous membrane, was that of Schiller, to whom the smell of rotten apples was so beneficial that he could not "live or work without it" (Lewes: Life of Goethe, London, 1864, second edition, p. 381).

north of Europe—that is, in Norway, Sweden, and Denmark—it is scarcely ever seen, and it rarely affects the natives of France, Germany, Russia, Italy, or Spain. In Asia and Africa, also, it is only the English who suffer. As far as I have been able to ascertain, the complaint is more common in the south of England than in the north; while in the north of Scotland it is very rare. In America it occurs in nearly every State, though diminishing in frequency toward the south. I think it extremely likely that the disorder will be found in Australia and New Zealand, but I am not aware that any cases have yet been reported from those countries. In support of the view that race has an important influence, Beard mentions that Dr. Jacobi, whose practice in New York lies largely among Germans, has never met with a case of hay fever in a patient of that nationality, and that Dr. Chaveau, of the same city, has never observed the complaint among his French compatriots residing there. Beard himself never heard of a case among Indians or negroes, except the instance related by Wyman, in which an Indian child was the subject of the disease.

The nervous temperament has undoubtedly a certain influence in predisposing to hay fever. This, of course, does not mean that all the patients are highly nervous people; some are of nervo-bilious, others of nervo-sanguineous temperament, but nearly all belong to the active, energetic class of so-called nervous organization.

One of the most singular features of this complaint is, that it is almost exclusively confined to persons of some *education*, and generally to those of fair social position. While I have notes of 61 cases of hay fever from my private practice,[1] and have seen many others of which I have kept no record, I have not met with one among my hospital patients. Of 48 cases which came more or less directly under the notice of Blackley, every one belonged to the educated classes; while out of 55 cases reported by Wyman, in 49 the patients were educated people. The influence of the *mode of life* is shown in the fact that the rustic is much less subject to the affection than the citizen. Thus farmers and agricultural laborers, who of all people are most exposed to the disease, very rarely suffer from it, there having been only 7 cases among the 200 reports collected by Beard. It is not possible to tell whether the villager owes his exemption to the vigorous health maintained by an outdoor life, or whether habitual exposure to the cause of the complaint begets tolerance; but the fact remains, that dwellers in towns are much more prone to the affection than those who live in the country.

Sex has a distinct influence, many more men than women suffering from the disease. Out of a grand total of 433 cases cited by Phœbus, Wyman, and Beard, only 142, or about a third, were females. Against these statistics it may be urged that the information on which they are based was collected by circulars, to which, perhaps, women would be less likely to reply than men. This objection, however, does not apply to my own cases, among which I met with 38 belonging to the male and only 23 to the female sex.

Heredity has likewise a powerful influence. This has been abundantly proved by Wyman and Beard, and it is supported by my own observations. In Wyman's experience there was heredity in 20 per cent., and in Beard's in 33 per cent. Out of my 61 cases, in 27 one or more near relatives had suffered in the previous generation. I have also several times treated father and children at the same time.

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[1] This was written in 1879.

Age to some extent governs the disorder. In the great majority of cases the liability to hay fever appears before the age of forty ; but several instances have been reported of the first occurrence of the malady in patients as old as sixty. It is somewhat rare for this affection to show itself in very young children, but I have seen it in one patient at two years of age, and in another at three. In these cases, as in all those of very young patients that have come under my notice, the little sufferers were the children of parents who had themselves been victims to the complaint. Had not the parents been subject to the affection, it is most likely that the true import of the symptoms would not have been recognized in the children, but would have been attributed to a common cold.

b. Exciting Causes.—A great variety of agencies have been looked upon as the direct causes of this disease, but there can now be little doubt that *pollen is the essential factor in the case of those who possess the peculiar predisposition.* Before, however, proceeding to show that pollen is the real cause of the affection, it may be well to pass in review some of the other sources to which its origin has been attributed. The most important of these are heat, light, dust, benzoic acid, coumarin, excess of ozone, and over-exertion, or several of these influences in combination.

Heat.—Popular observation had already associated hay fever with effluvia from grass or hay, at the time when Bostock, from his own personal experience, put forth the view that the affection was due to the influence of solar heat. The obvious difficulties in the way of this theory led Phœbus to attribute the affection to "*the first heat of summer*," which, he observed, "is a stronger cause than all the grass emanations put together." Later on, however, Phœbus remarked that "the first heat of summer only acts in an indirect manner as an exciting cause ;" and he admitted that hay and the blossom of rye cause exacerbations. Heat alone will not, however, produce the disease. It is not met with in the plains of India when the heat is greatest, though occasionally it is seen in the cooler months before the vegetation is burnt up. Hay fever is also found in the milder climate of the Indian hills, when the grasses and cereals are in blossom. The intense heat of the desert does not produce the disease, nor does it occur at sea in the sultry equatorial regions, though the heat when vessels are becalmed, is sometimes almost beyond endurance. In America, hay fever is much more common in autumn than in the tropical summer of that country.

Light.—The observations as regards heat apply equally to light. Phœbus thought that the *longer days*, which produce a more continuous action of light, are perhaps to blame ; but where the light is strongest and lasts longest, indeed in the land of "the midnight sun," hay fever is almost unknown. At sea, when the sun is bright, it is well known that nothing can exceed the glare ; yet a sea-voyage is the best safeguard for the sufferer from hay fever. Persons with a sensitive mucous membrane, especially those subject to hay fever, are no doubt sometimes liable to attacks of sneezing from sunlight, and incautious observers might mistake these symptoms for true hay fever. Some of Beard's patients even attributed the affection to gaslight, but gaslight is used much more in winter when hay fever is absent, than in the English summer and American autumn, when the affection prevails.

Dust.—This is a more difficult subject to dispose of. Most writers who accept dust as a cause of summer catarrh, speak of "common dust," but as Blackley remarks, there is no such thing as *common* dust. The constitution of dust depends upon the geological character of the soil, upon the vegetation which it supports, and on the season of the year, as well as on "the number and kind of germs and other organic bodies" present in the atmosphere. Beard's statistics, if accepted without consideration, strongly point to dust as the most common cause of hay fever, for out of 198 patients no less than 104 attributed the affection to dust. Of these 198 cases, however, 142 occurred between May and September ; and it may well be asked : How was it that dust did not affect these patients in the winter months ? Does this not clearly point to the presence in the dust of some special irritant during the summer and autumn months, which does not exist at other times ? In England, in the months of February, March, and April, when strong east winds often blow clouds of dust against the face, symptoms of hay fever do not appear, while in June and July, when there is comparatively little dust, hay fever attacks its victims. It is true that in many of

Beard's cases, collected by circulars, the patients attributed the affection to "indoor dust," and some even to "cinders." But as people stay in the house more in winter than in the autumn and summer, and use fires at that time, these agencies, if of any real power, would produce their greatest effect in winter. Directly the opposite, however, occurs. Is it not highly probable, therefore, that these patients were misled as to the real cause of the malady? We all know how easy it is for the trained physician to make erroneous observations and to overlook important physicial signs and how much more likely is the untutored patient to make a mistake in the obscure and highly complicated problems of etiology!

Ozone, Benzoic Acid, etc.—An excess of ozone in the atmosphere was suggested by Phœbus as a possible cause of hay fever, but Blackley purposely breathed air highly charged with this substance for five or six hours without effect. He, moreover, inhaled artificially prepared ozone, in quantities far exceeding what is ever found in the same volume of atmospheric air, without feeling any inconvenience. The same physician also studied the effects on his own person of benzoic acid,[1] coumarin (the odorous principle of many flowering grasses), and of the volatile oils which impart to many plants, such as peppermint, juniper, rosemary, and lavender, their characteristic perfume. The results were in all these cases entirely negative.

Over-exertion, or prolonged exercise in the open air, never has any effect in cold weather, or indeed at any other time except when grass is in flower. Its influence, however, in *aggravating* hay fever, in the hay season, is very great, and will presently be considered.

Combined Causes of Hay Fever.—Several writers have contended that although any one of the above causes may not alone be sufficient to produce hay fever, several of them acting together may be able to do so. Such theories are the last resource of those who are unable to discover the true etiology, and there is not a tittle of evidence in their support.

Having shown what does *not* generate hay fever, its real mode of origin must now be demonstrated.

Blackley's observations leave no doubt that the cause of hay fever is *the action of pollen on the mucous membrane.* His experiments were framed on a most comprehensive plan, and carried out in a rigorously scientific spirit. By well-devised tests he succeeded in proving—first, that in his own person the inhalation of pollen always produced the characteristic symptoms of hay fever; secondly, that in his own case, and in that of two other persons, there was a direct relation between the intensity of the symtoms and the amount of pollen floating in the air; and thirdly, as already shown, that none of the other agents referred to, such as heat, light, dust, odors, or ozone, can of themselves cause the complaint.

Blackley's experiments were made with pollen of various grasses and cereals, and with that of plants belonging to thirty-five other natural orders.

The grasses which, as already stated, were at one time considered to be especially active are the *anthoxanthum odoratum* and the *holcus odoratus*, but this idea no doubt originated in the extremely fragrant odor of these plants, and there is no reason to suppose that their pollen is more active than that of the *alopecurus pratensis*, and the various *poœ* and *loliœ*. The pollen of rye is, however, more potent than some of these, and that of wheat, oats, and barley is also very active. The careful observations of Blackley show that in England, during the season of hay fever, ninety-five per cent. of the pollen contained in the atmosphere belongs to the *gramineœ*. This order generally comes into full blossom between *the end of May and the latter part of July*, and that is precisely the period of the year when hay fever prevails. If the season be wet and cold the disease usually

[1] This substance has been shown by Vogel to be contained in *anthoxanthum odoratum* and *holcus odoratus*, the two species of flowering grasses to which the causation of hay fever has been in a special manner attributed.

sets in rather later, and is milder in character than when the weather is fine, and the vegetation luxuriant.

There are persons in whom the presence of roses will give rise to an attack, and in America the affection is sometimes called "rose fever." No doubt it is the pollen of the rose which is the active agent. The celebrated Broussais [1] appears to have been impeded in his botanical studies by this idiosyncrasy, while the case related by Hünerswolff [2] of a man in whom the perfume of roses invariably produced an attack of coryza has been often cited by modern writers. I have myself met with a similar case. A lady living in Devonshire consulted me in 1864, on account of constant severe coryza, which came on whenever she smelt a rose. All treatment proved futile, and she was ultimately obliged to banish these flowers from her garden.

In America the pollen of the Roman wormwood (*ambrosia artemisiæfolia*) appears to be the most common cause of hay fever. This plant (which belongs to the genius *ambrosiaceæ*, order *compositæ*) is not met with in Europe, but is extremely common in nearly every part of the United States. Wyman [3] found that when a parcel containing this plant was opened at White Mountain Glen, where he had retired in order to avoid hay fever, he and his son were immediately attacked with all the symptoms of the malady. *The plant blossoms in August and September, and it is then that hay fever most prevails in America.* Several varieties of the *artemisiæ*, a closely-allied genus, are met with in England, and I think it not improbable that some cases of hay fever which have occurred at the seaside in this country may have been due to the pollen of the *artemisia maritima*, or its variety, *artemisia gallica*. It is curious that, except in the case of Indian corn, the pollen of *grasses* appears to have but slight effect in America, though a mild form of hay fever is met with in that country from May to August.

There are certain supposed fallacies in the pollen theory which must be referred to. Thus a case is mentioned by Walshe,[4] in which the patient retained the symptoms of hay fever during a passage across the Atlantic, and another has been reported by Abbott Smith,[5] in which the disease came on at a distance of nine miles from land. These are, I believe, the only authenticated instances in which hay fever has continued to exist, or has originated at sea, and they are open to various explanations. It has been distinctly shown by Blackley that pollen may be retained in an article of dress for many weeks, and in Smith's case, the patient, who was yachting, experienced the symptoms after assisting "to hoist the sails." The attack came on on June 13th, and it is not unlikely that when the sails were unfurled a large quantity of pollen collected in their folds was set free. In Walshe's case, the symptoms may have been kept up by some other irritant to which the patient may have had a peculiar susceptibility, or the case may not have been a true example of hay fever, but of ordinary asthma, complicated with catarrh. It is not altogether impossible, however, that pollen may be deposited on a ship miles away from land. Darwin [6] has shown that dust is sometimes thus de-

[1] Anglada: Du Coryza simple, Thèse de Paris, 1837, p. 14.
[2] Ephem. Nat. Curios, dec. ii., ann. v., obs. xxii.
[3] Op. cit., p. 101.
[4] A Practical Treatise on Diseases of the Lungs, London, 1871, fourth edition, p. 228.
[5] On Hay Fever, London, 1866, fourth edition.
[6] Journal of Researches, etc., London, 1845, second edition, p. 5.

posited far out in the Atlantic. "The dust," he observes, "falls in such quantity as to dirty everything on board and to hurt people's eyes; vessels have even run on shore owing to the obscurity of the atmosphere." Again, in speaking of the distribution of pollen, Darwin reminds us that the ground near St. Louis, in Missouri, has been seen covered with pollen as if it had been sprinkled with sulphur, and there is good reason to believe that this had been transported from the pine forests at least four hundred miles to the south.[1] A shower of yellow pollen was wafted to Philadelphia[2] from some distant pine forest so recently as March 16, 1883. It caused such a thick deposit as to lead ignorant people to take it for brimstone. These facts are sufficient to show that the influence of pollen may be experienced under circumstances where it would not generally be looked for.

While asserting that pollen is the universal cause of the peculiar form of catarrh known as hay fever, I do not mean to deny that other irritating particles might produce a similar complaint if persistently brought in contact with the mucous membrane. Thus, it is well known that powdered ipecacuanha will in some persons cause a peculiar form of asthma closely resembling hay asthma, and with many people the fumes of burning sulphur have the same effect. I have frequently observed slight attacks resembling hay fever produced by the insufflation into the larynx of powdered lycopodium, and, indeed, I have for this reason been compelled to give up the use of this drug as a diluent for medicinal powders. Some people experience symptoms somewhat analogous to those of hay fever from smelling certain fruits, while others are troubled in the same way by the presence of cats, rabbits, and guinea-pigs, and Bastian[3] suffered from an affection closely resembling hay fever in dissecting the *ascaris megalocephala*, a parasite which infests the horse. If the specific exciting influence is kept in operation on a person subject to an idiosyncrasy of this kind, a complaint almost precisely similar to hay fever is produced; but as a rule, the conditions leading to its manifestation are exactly known by the patient, and can therefore be avoided. The etiological peculiarity of hay fever consists partly in the fact that the idiosyncrasy as regards pollen is more common than other individual susceptibilities, but chiefly in the circumstance that at certain seasons pollen exercises its influence over wide areas, and can be excluded only with great difficulty.

In a recently published article, Daly,[4] of Pittsburg, has endeavored to show that in a large proportion of cases there is an intimate relation between hay asthma and chronic nasal catarrh, and that except when disease of the nasal mucous membrane exists the alleged exciting cause of summer catarrh is inoperative. He reports two cases of thickening of the turbinated bodies, and one of polypus, in which, after the cure of the local condition, the patients lost their susceptibility to hay fever. These persons had suffered from summer catarrh for twenty-one, fifteen, and six years respectively. Roe[5] and Hack[6] have since enunciated similar views to those propounded by Daly. It is not at all unlikely that an unhealthy state of the mucous membrane of the nasal fossæ may predispose to hay fever, but I may remark that I have repeatedly examined the interior of the nose in cases of hay fever without finding anything more than general congestion.

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[1] The Effects of Cross and Self-Fertilization in the Vegetable Kingdom, London, 1876, p. 405. [2] Philadelphia Med. News, April 7, 1883.

[3] Philosophical Transactions, 1866, vol. cvi.

[4] Archives of Laryngology, 1882, vol. iii., No. 2. [5] Loc. cit. [6] Loc. cit.

Symptoms.—The disease shows itself under two well-marked types, the catarrhal and the asthmatic. In the former the onset is very sudden, the patient becoming conscious of an itching, smarting sensation in the nose and eyes, and sometimes in the fauces and roof of the mouth. Not unfrequently the attack commences with a feeling of extreme irritation at the inner canthi. Paroxysms of sneezing, often of extreme violence, quickly ensue, followed by an abundant thin discharge from the nose. The mucous membrane of the nasal fossæ swells so as to block up the passages and make respiration through them impossible. At the same time there is profuse lachrymation with much pricking and stinging of the conjunctival surfaces and sometimes photophobia. There is often a certain amount of chemosis, and occasionally the eyelids become puffed so as almost to close the eyes. The discharge from both nose and eyes gradually grows thicker, and sometimes becomes even semi-purulent in character. There may be severe neuralgic pain in the eyeballs and over the back of the head. Now and then there is some degree of pyrexia, but this is by no means the rule. The disorder often varies considerably in intensity, even in the same person within short intervals of time, so as almost to give an intermittent character to the complaint. This is due to the varying quantity of pollen present in the atmosphere, the severity of the disease being, as a rule, in direct proportion to the abundance of the *materies morbi*. An attack lasts from a few hours to several days, or even longer, finally ceasing almost as suddenly as it set in, and leaving little or no trace of its presence either in local lesion or systemic disturbance. In some patients hay fever is accompanied by nettle-rash.

The asthmatic form of the complaint may be superadded to the disorder just described, or may constitute the entire affection. It generally comes on in the daytime, and the paroxysm may pass off in a few hours, the patient first expectorating a little ropy mucus and later an abundant frothy secretion, or there may be only a slight remission, the dyspnœa continuing as long as the sufferer is exposed to the influence of pollen. The attacks seldom produce any emphysema, and the patient sooner or later entirely recovers.

Diagnosis.—From the resemblance of hay fever to common catarrh on the one hand, and to spasmodic asthma on the other, mistakes in diagnosis were formerly very common; but the disease is now so well known that errors are not likely to occur. The first attack might perhaps be confounded with ordinary coryza; but the suddenness of the onset, the characteristic œdematous puffiness of the eyelids, together with the absence of constitutional symptoms, will speedily lead to a truer diagnosis. People who are prone to catarrh are very apt to catch cold in the changeable weather of the spring and early summer of this country, and these cases are sometimes mistaken for hay fever; but the readiness with which they yield to anti-catarrhal treatment at once shows their real nature.

The asthmatic form of hay fever may, in some instances, be less easy to recognize; but the history of the case will generally guide the practitioner to a correct opinion. The fact that hay fever often comes on in the daytime, out of doors, and in the summer, while paroxysms of true asthma most frequently occur in the evening or night indoors, and in one of the other seasons of the year, may help to differentiate the two complaints.

Prognosis.—This is in all cases favorable as regards the termination of each attack; *cessante causâ, cessat effectus.* When the season of flowering grass is past the complaint will certainly depart; but it will almost as

surely reappear whenever the patient is again exposed to the action of pollen.

Pathology.—Hay fever leaves no permanent structural lesion behind it. Blackley thinks that pollen has a peculiar and specific effect in causing dilatation of the capillaries and exudation of serum from them; but it appears to me highly doubtful whether this is anything more than the reaction which follows the application of an irritant.

Treatment.—In no disease is the old adage, that "prevention is better than cure," more truly applicable than in the case of hay fever. If the poison be continually introduced into the system, the antidote, if one exists, can have but little chance of effecting a cure. The first measure, therefore, must be to remove the patient from a district in which there is much flowering grass. A sea-voyage is probably the most perfectly satisfactory step that can be taken. Patients who are unable to go to sea should endeavor to reside at the seaside, where they will generally be free from their troublesome complaint, except when land-breezes blow. Dwellers in towns should avoid the country, and those who reside in the country should make a temporary stay in the centre of a large town. It often happens, however, that such a change of abode is not practicable, and, under such circumstances, if the complaint is very severe, the patient should, if possible, remain indoors during the whole of the hay season. Many persons, of course, cannot keep to the house during the month or six weeks of the hay fever period; and those who can are apt to find such detention not only exceedingly irksome, but very injurious to the health. If, therefore, a patient is obliged to go out of doors he should plug his nostrils with cotton-wool or wadding by means of Gottstein's screw (Fig. 73, p. 196), and should defend his eyes by wearing spectacles with large frames, accurately adapted to the circumference of the orbits.[1] Protected in this way, many people predisposed to hay fever escape altogether, while others contract the affection in a very mild form.

As the disease most commonly occurs in persons of nervous temperament, nerve-tonics and other constitutional remedies have been used for the purpose of warding off hay fever, or controlling the violence of its attacks. Among these, quinine, arsenic, opium, and belladonna have been employed, but I have found valerianate of zinc, in combination with assafœtida, more valuable than any other drug. I usually give the remedy in the form of pills containing one grain of valerianate of zinc and two grains of the compound assafœtida pill. I direct my patients to begin taking these pills as the hay season approaches, and under the use of this remedy persons who formerly suffered most severely from hay fever have in many cases ceased to be troubled with it.

When the disease is established, tincture of opium is of great benefit in controlling hay asthma, reducing the secretion, diminishing the sneezing, and at the same time bracing up the nervous system. It should be given in the manner recommended for acute catarrh (p. 202), but continued for a longer time. Belladonna has been recommended, but I have had no experience of its use in this complaint.

I trust very little to local measures in the treatment of hay fever, but when there is profuse secretion with an excessive tendency to sneeze, the inhalation of strong ammonia salts often gives great relief. I have not found injections of quinine, as recommended by Helmholtz, at all useful.

[1] Both the screw and the spectacles are sold by Messrs. Mayer & Meltzer, Great Portland Street, London.

Though in a few cases benefit was derived, in most instances no effect was produced, while some patients were actually made worse. The vapor benzoini of the Throat Hospital Pharmacopœia has occasionally produced a soothing effect, and I have also seen good results from insufflations into the nose of a powder consisting of one-sixteenth of a grain of morphia and one grain of bismuth. This should be applied several times a day. Ferrier's snuff (see Appendix) may be substituted for the above formula, but it should be applied by insufflation.

In a few cases I have seen some benefit from the use of medicated bougies, such as the bismuth, and acetate of lead Buginaria of the Throat Hospital Pharmacopœia (see Appendix), but, like quinine, they occasionally aggravate the mischief they are meant to cure.

The upper lip and the margins of the nostrils should be smeared over with benzoated zinc ointment two or three times a day.

For the relief of the irritation of the eyes, frequent bathing with very cold water is sometimes useful, though Roberts [1] appears to have found more benefit from warm and slightly salt water. Sulphate of copper gr. ij. ad ℥ j.) or sulphate of zinc (gr. ij. ad ℥ j.) may sometimes do good, but I have found a lotion containing two grains of acetate of lead with two drops of dilute acetic acid in an ounce of water, the most soothing application.

Asthmatic patients often derive benefit from inhaling the fumes of nitrated blotting-paper (see Appendix, vol. i., p. 421), the good effect of which is further increased by steeping the paper in a solution of stramonium, datura tatula, belladonna, or lobelia.

CHRONIC NASAL CATARRH.

Latin Eq.—Catarrhus longus.
French Eq.—Coryza chronique.
German Eq.—Chronischer Nasencatarrh.
Italian Eq.—Corizza cronica.

Definition.—Chronic inflammation of the lining membrane of the nasal fossæ characterized by swelling of the mucous membrane, by increase in the natural secretion, by more or less obstruction of the nasal passages, nasal voice, and impairment or loss of smell. The affection sometimes causes a watery flux, and when neglected may give rise to great hypertrophy of the turbinated bodies.

History.—Since the issue, many years ago, of Cazenave's [2] two papers, little attention was directed to the complaint until it began to be studied by American physicians. Excellent practical articles have recently been published by Solis-Cohen,[3] Beverley Robinson,[4] and Bosworth ; [5] while Rumbold [6] has given his views on the disease at great

[1] New York Med. Gaz., October 8, 1870.
[2] Sur le Coryza chronique. Paris, 1835 ; another article, 1848. This physician practised at Bordeaux, and must not be confounded with his celebrated namesake of Paris.
[3] Diseases of the Throat and Nasal Passages, New York, 1879, second edition, p. 346 et seq.
[4] Practical Treatise on Nasal Catarrh. New York, 1880, p. 69 et seq.
[5] Manual of Diseases of the Throat and Nose, New York, 1881, p. 179 et seq.
[6] Hygiene and Treatment of Catarrh, St. Louis, 1880.

length. In Europe the subject has been treated by Michel,[1] Tillot,[2] Löwenberg,[3] and Bresgen.[4]

Etiology.—The commonest cause of chronic catarrh is the previous occurrence of acute attacks. The most obstinate cases are generally supposed to depend on the strumous diathesis, or to occur in persons who have suffered from constitutional syphilis; but I have sometimes found the complaint very intractable when there was not the slightest evidence of any constitutional taint. The disease may commence at any period of life, but is most common in childhood, when it is occasionally caused by the presence of adenoid vegetations in the naso-pharynx. In the aged it often assumes the character of a mild flux, producing the "bead" at the end of the nose, made so familiar by caricaturists. Chronic catarrh may be induced by any of the various causes referred to in connection with acute catarrh, such as the inhalation of irritating vapors, or of solid particles suspended in the atmosphere. Snuff-takers and spirit-drinkers are generally subject to chronic catarrh of the nose, and while the affection is occasionally the cause, it is often the consequence of a polypus in the nasal cavity.

Symptoms.—An increased secretion of mucus is the most common symptom of chronic nasal catarrh, but the patient almost always experiences a feeling of "stuffiness" in the nose. There is often sufficient obstruction to interfere with nasal respiration, and the well-known alteration in the character of the voice, already described in dealing with acute catarrh (p. 201), is produced. The patient in such a condition is popularly said to speak "through his nose," though as a matter of fact the peculiarity is due to obstruction of the nasal passages. The affection sometimes extends to the naso-pharynx, and may even spread up the Eustachian tube, and give rise to catarrh of the middle ear and serious deafness.[5] In severe cases the tear-duct is often obstructed, and, as Bresgen[6] has pointed out, even when the complaint is slight the skin of the nose, especially near its tip, is generally red.

Occasionally, on the other hand, the complaint consists of a constant running of watery fluid from the nose, constituting a veritable *rhinorrhœa,* the secretion being sometimes so abundant as to cause the greatest inconvenience. I have treated several cases in which the patient has been obliged to use fifteen or twenty pocket-handkerchiefs in a single day, and one in which from thirty-two to thirty-five were required daily for a fortnight. A good example of the affection is related by Morgagni,[7] in which

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[1] Krankheiten der Nasenhöhle. Berlin, 1876.

[2] Annales des Maladies de l'Oreille, etc., 1879.

[3] Union Médicale, July 28, 1881.

[4] Der chronische Nasen und Rachen-Katarrh. Wien und Leipzig, 1883.

[5] Dr. Rumbold, whose work on catarrh has already been referred to, states (pt. ii., pp. 239, 240) that in the course of eighteen years of practice he has "had many patients, amounting to several hundred, whose mental condition has been more or less affected by this inflammation extending from the nasal passages to the membranes of the brain. . . . Uncontrollable melancholia and dissatisfaction, inability to think consecutively, to recollect the common matters of life, to add up a column of figures, to remember immediate relations' names," are some of the distressing symptoms exhibited by Dr. Rumbold's patients. Others forget even their own names, while one unfortunate gentleman, whose nose was no doubt in an exceptionally morbid state, "experienced the sensation, while walking, that he was sinking into the pavement up to his knees." Such complications of catarrh, however, are fortunately not met with in this country.

[6] Op. cit., p. 70.

[7] De sedibus et causis morborum, epist. xiv., sec. 21.

a woman suffered from a discharge of "watery fluid" from the left nostril (after the other symptoms of an ordinary catarrh had left her) for several months. About half an ounce passed every hour, and the patient, who had been fat and florid, wasted away. On the stoppage of the rhinorrhœa she recovered weight. The same writer quotes from Bidloo an instance, apparently of traumatic origin, in which twenty-five ounces of pale fluid were discharged from the right nostril in twenty-five hours. A still more remarkable case is related by Elliotson,[1] where a lady on two different occasions suffered from profuse discharge of watery fluid from the left nostril, the first attack having lasted eighteen months, and the second twenty-three. It was estimated that during the first attack she passed one hundred and ninety-three gallons of fluid in all, while during the second, three quarts were discharged in a single day. On the first occasion the affection ceased suddenly without any apparent cause; on the second it stopped gradually under the internal and local use of sulphate of zinc prescribed by Sir Benjamin Brodie,[2] but as no amelioration whatever took place during the first three weeks of this treatment, Elliotson doubts whether the remedy really had any effect in controlling the disease.

It will be understood from the above description of the very varying character of the secretion that the condition of the mucous membrane itself must differ greatly in individual cases. On examining the nose in ordinary cases of chronic catarrh the mucous membrane is seen to be red and succulent, and covered here and there with patches of thick, moist, yellow secretion, or with a few thin flakes of dried mucus. In rhinorrhœa, on the other hand, the lining membrane is usually pale and sodden. If the disease exists for any length of time, some of the morbid changes described in the next article may be seen. In all cases of chronic inflammation, abrasions of surface are apt to occur, and these sometimes give rise to small ulcers, causing great annoyance by exciting a sensation of tingling and heat in the nose, which often leads the patient (especially if a child) to pick off the scabs and thus increase the irritation. The ulcers most frequently form in the mucous membrane covering the cartilaginous septum just inside the nose, and in neglected cases perforation may take place, and a permanent aperture result.

Diagnosis.—If a complete examination can be made, and it can be ascertained that neither polypi, polypoid tumors, nor post-nasal adenoid growths are present, there will be no difficulty in determining the nature of the affection, which, indeed, is generally quite obvious. It is only in cases of severe rhinorrhœa that any doubt can arise, and in these it must not be forgotten that excessive discharge of a watery fluid from the nose may be caused by a polypus in the antrum,[3] or may be of reflex character and result from disease or injury of the fifth nerve,[4] from optic neuritis,[5] and probably from even more remote sources of irritation.

Prognosis.—With ordinary care a favorable result may always be predicted, but there is a great tendency to recurrence in the old, the very young, and in persons of debilitated constitution. It is most important, however, to cure every case as quickly as possible, especially in young

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[1] Med. Times and Gaz., September 19, 1857.
[2] Quoted by Elliotson, loc. cit.
[3] Paget: Trans. Clin. Soc., 1879, vol xii., p. 43 et seq.
[4] Althaus: Brit. Med. Journ., 1868, vol. ii., p. 647 et seq.
[5] Nettleship: Ophthalmic Review, January, 1883, vol. ii., No. 15, p. 1 et seq. Priestley Smith: Ibid., p. 4 et seq.

children, lest the disorder should lead to hypertrophy, or possibly to atrophy and ozæna.

Pathology.—Little is known as to the local condition in ordinary chronic catarrh of the nose, but it is likely that the usual phenomena characterizing chronic inflammation in mucous membranes are exhibited in such cases. Infiltration of the sub-epithelial connective layer, with consequent thickening and induration of the membrane and atrophy of the glandulæ owing to the pressure exercised on them by the tissues in which they are imbedded, probably constitute the sum of the morbid changes to which chronic catarrh gives rise within the nose, though the troublesome sequelæ detailed in the next article are not unlikely to occur in protracted cases.

Treatment.—Astringent washes, douches, and sprays are generally the best remedies, but it is very important to remember that the mucous membrane of the nose will not bear nearly such strong medicaments as the pharynx or larynx. Simple alkaline solutions, such as bicarbonate of soda (gr. x. ad ℥ j.), often answer perfectly well, but the remedy which I have found most effectual is the "compound alkaline wash" (see Appendix, Nasal Washes). Several of the collunaria contained in the Throat Hospital Pharmacopœia are sometimes of service, especially the coll. acidi tannici, and the coll. aluminis. If washes and douches cause pain, sprays may be employed, and they are likely to be most useful when the secretion is thin and abundant. In such cases I have known a spray of tannic acid (gr. iij. ad ℥ j.), or alum (gr. iv. ad ℥ j.), rapidly effect a cure in cases that have been going on for months and even years. If solutions do not succeed, some of the astringent or sedative powders, the formulæ for which will be found in the Appendix, may be blown into the nose once or twice daily by the patient with Bryant's auto-insufflator, or the same class of remedies may be employed as snuff. Porter,[1] of St. Louis, has found the frequent use of a snuff composed of camphor, tannic and salicylic acid very advantageous. In long-standing cases medicated bougies, as first recommended by Catti,[2] are often of great service, the Buginarium bismuthi, and the B. plumbi acetatis (Throat Hospital Pharmacopœia) being especially efficacious. Should there be much swelling of the mucous membrane a gum-elastic bougie (p. 177) should be passed into the nose every day, and at first allowed to remain *in situ* for a few minutes. This period may be gradually extended to half an hour, a larger instrument being used as the passage widens.

In some cases, however, every kind of local treatment seems only to irritate, while a cure can be quickly effected by keeping the mucous membrane at rest. With this view it is very important that the patient should be directed not to *blow* his nose, the forcible removal of the mucus causing an increased flow of blood to the part, and consequently a more copious secretion. If the patient will submit to the slight inconvenience occasioned by the collection of mucus, and merely *wipe* the nose from time to time, the secretion will diminish, and will soon cease to be troublesome. Sneezing should, if possible, be prevented in the manner already recommended (p. 203). Should hypertrophy of the mucous membrane take place, the case will probably require to be treated by some of the various measures described in the next article.

In obstinate cases, and especially when old persons are the subjects of the complaint, constitutional treatment of an analeptic and tonic character

[1] St. Louis Med. and Surg. Journ., December, 1875.
[2] Zur Therap. d. Nasenkrankheiten, Wien. med. Zeitschr., 1876.

should be carried out, and above all things, such patients should be enjoined to seek, if possible, a warm and dry climate. Where the complaint is of a secondary character, the original malady must be removed before a cure can be looked for.

HYPERTROPHY OF THE MUCOUS MEMBRANE OF THE NOSE.

When chronic catarrh of the nose has existed for some years, and, indeed, in children of scrofulous type, when it has troubled the patient for only a few months, great thickening of the mucous membrane sometimes takes place. This hypertrophy may involve either the front or back portion of the nasal passages. The color of the swollen mucous membrane is generally bright red in front, but of a duller red or purple tint in the posterior portions of the nose. The anterior extremity and the whole lower border of the inferior turbinated body is perhaps the most common site of

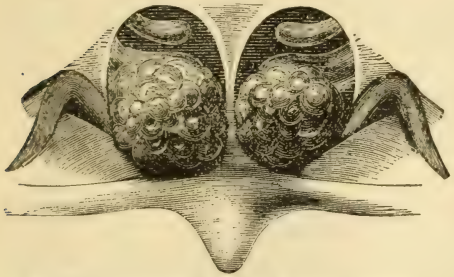

Fig. 75.—Hypertrophy of both Turbinated Bodies. (Seen from behind.)

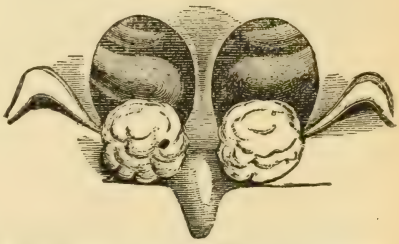

Fig. 76.—Showing the Pale Variety of Hypertrophied Tissue. (Seen from behind.)

the hypertrophy, which in the latter situation is occasionally so considerable as completely to block up the inferior meatus. Less frequently the middle turbinated bodies are the seat of hypertrophy. When the thickening affects the posterior part of the lower turbinated bodies, instead of producing a more or less uniform swelling of the tissues, it more often leads to the development of numerous dark red or purple polypoid vegetations, giving the turbinated body a somewhat mulberry-like appearance (Fig. 75). Sometimes the growths are pale, and appear to hang down from the choanæ toward the uvula (Fig. 76). These excrescences bleed readily, though only slightly, when touched. Whether the hypertrophy involves the anterior or the posterior portion of the turbinated bodies, if at all considerable, the swelling is almost always bilateral, and generally symmetrical. Occasionally the septum is greatly thickened, the hypertrophy usually occurring at the lower and back part.

The *symptoms* are the same as those of ordinary chronic catarrh, but intensified, the patient being often quite unable to blow his nose, and being obliged to breathe entirely through the mouth. The voice is persistently nasal, and the patient, if a child, always keeps the mouth open, presenting the well-known stupid appearance which has already been described in connection with the subject of enlarged tonsils (vol. i., p. 47). It has recently been noticed by several physicians that obstruction of the nasal passages is apt to give rise to very troublesome reflex phenomena,

such as asthma, cough, and even epilepsy, complications which will be considered in dealing with polypus of the nose (see p. 250 et seq.). These phenomena, however, are not nearly so frequent in cases of simple hypertrophy as in polypus, the probable reason being, as suggested by Hack,[1] that the morbid alteration of structure destroys the cavernous tissue, diminishes sensibility, and thereby lessens reflex excitability.

The *diagnosis* is easy, for a careful examination with the speculum and rhinoscope will usually reveal the nature of the case. Those, however, who are not practised in the examination of the interior of the nose sometimes mistake a thickened condition of the mucous membrane covering the lower spongy bone for a polypus. It is only necessary, however, to bear in mind the fact that hypertrophy is nearly always bilateral, and in most cases symmetrical, a circumstance which generally serves to differentiate the affection from polypus. Moreover, catarrhal thickening chiefly affects the *lower* turbinated bodies, while true polypi, as a rule, spring from the mucous membrane covering the *middle* and *upper* bones or the corresponding meatuses. Cases not unfrequently occur, however, in which polypi and hypertrophy coexist, and occasionally one of these conditions conceals the other. Gottstein[2] has pointed out that it is not always possible at first to distinguish between the swelling produced by chronic perichondritis and that due to simple hypertrophy. In a very instructive case related by that observer, the appearance was entirely that of hypertrophic catarrh; but after an absence of two months the patient, who meanwhile had remarked no change in his symptoms, returned with extensive destruction of the septum, due to the perichondritis which had doubtless existed all along.

The *pathological changes* which sometimes result from chronic nasal catarrh are no doubt largely due to the peculiarly vascular and cavernous structure of the turbinated bodies (see Anatomy, p. 163). The hypertrophy occasionally produces an appearance somewhat resembling in form the *flocculus* of the cerebellum, but of a bright pink or deep red color. This is well shown in the annexed cut (Fig. 77), copied from a specimen in the Museum of the Royal College of Surgeons. The morbid process has been carefully studied and well described by Bosworth[3] and Seiler.[4] From the investigations of these observers, it would seem that the changes which take place are similar to those commonly observed in chronic inflammation of mucous membranes. Thus the epithelial cells are increased in number, and though showing no marked tendency to desquamation, are seen here and there to be undergoing fatty degeneration; the basement membrane is thickened, the mucosa densely infiltrated with small cells; the glands and their ducts are filled with proliferating epithelium, the blood-vessels increased, both in size and in number, and the trabeculæ and sinuses greatly enlarged.

There is no doubt a close connection between thickening of the nasal membrane and genuine polypus. The two conditions are frequently found associated, and a good illustration of this is afforded by a specimen in the Museum of the College of Surgeons, a woodcut of which will be found further on (see Fig. 79, p. 253). Some cases classified as hypertrophy of

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[1] Neue Beiträge zur Rhinochirurgie. Wien, 1883.

[2] Berlin. klin. Wochenschrift, 1881, No. 4.

[3] Trans. Intern. Med. Congress, London, 1881, vol. iii., p. 327 et seq.; and The (New York) Medical Record, June 10, 1882.

[4] Philadelphia Med. Times, January 14, 1882. See also the report of a case by Thierfelder (Atlas der path. Histol., Lief. 1) referred to by Seiler.

the nasal mucous membrane are also probably of papillomatous nature (see Papilloma of the Nose).

The *prognosis* is favorable, for almost every case can be cured by suitable treatment.

The *treatment* frequently needs to be of a vigorous character, but at an early stage the mildest measures are sometimes sufficient, the daily use of gum-elastic bougies often effecting a cure. The smallest size of instrument should, as a rule, be used at first, and at the beginning of the treat-

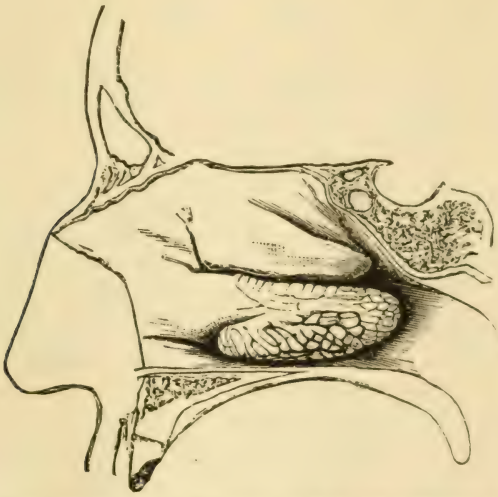

FIG. 77.—Hypertrophy of the Posterior Three-fourths of the Lower Turbinated Body. From Specimen No. 2.201c in the Royal College of Surgeons' Museum. (The outline of the nose has been added by the artist.)

ment the bougie should be left in the nose for no longer than five minutes at a time ; after a few days, however, it may remain *in situ* from ten minutes to a quarter of an hour, and at the end of a week it can be easily tolerated for half an hour. Larger bougies should afterward be employed, but force must be carefully avoided. Mild alkaline sprays or hand-washes are often of great service if the treatment is perseveringly carried out. Sneezing must be checked by smelling strong ammonia or acetic ether.

Should this plan not succeed more active steps must be taken ; but a word of caution is perhaps necessary in connection with this point. For, though the introduction of the electric cautery and the wire écraseur permits some relaxation of the rule under which surgeons were taught "to cut through everything soft, to saw through everything hard, and to tie everything that bleeds," the spirit of this simple instruction has, I fear, in recent years, sometimes influenced the young practitioner, and the nasal passages have occasionally been "cleared" with a zeal and energy worthy of the industrious backwoodsman. In several cases that have come under my own care, in which severe measures had previously been urgently advised by others, I have succeeded in effecting a cure by the simple removal of all causes of irritation and the persevering use of gentle dilatation. I would also warn some of my younger *confrères* that as the appearance of the interior of the nose varies immensely in healthy persons, it is unnecessary, where no inconvenience is felt, to restore geometrical symmetry

to the turbinated bodies, or to invest the lining membrane of the nose with artistic merit. But while deprecating unnecessary aggression in this tender region, I do not deny that there are many cases which can only be cured by active treatment.

Should the hypertrophy resist the measures already recommended, the redundant tissue must be destroyed or removed. Destruction with electric cautery will be found the most simple and efficacious method. If the thickening is in the anterior part of the nose, the nostrils should be well dilated with a speculum, and the exuberant tissue carefully destroyed with the porcelain knob electrode, or removed with the hot loop (see vol. i., p. 372, Fig. 101, *c* and *d*), or a number of slight lines may be burnt with the spatula-like points (vol. i., Fig. 101, *a*). If the thickening affects the central portions of the turbinatad bodies Löwenberg's electrode (p. 190) answers well, and when the posterior part of the middle turbinated bodies is involved, Lincoln's instrument (Fig. 61, p. 191) will be found very serviceable. In applying electro-cautery, as already remarked, I endeavor to avoid employing a protective shield, the loss of space and contracted field of vision involved in the use of such an instrument often more than neutralizing any advantage which it may possess. Sometimes, however, when the swelling is very great, a shield is required, and in these cases I find Shurly's instrument (see p. 177) the best. Instead of electric cautery Paquelin's thermo-cautery, as modified by Goodwillie,[1] can be tried; but as this instrument has to be introduced red hot, it is more likely to cause accidental injury than electric cautery, and it can seldom be used except when the patient is under chloroform. Those who have neither this instrument nor any convenient electric apparatus at hand, can destroy the redundant tissue by means of London paste (Throat Hospital Pharmacopœia), nitrate of silver, or glacial acetic acid. The two first-named caustics can be readily applied with the pharyngeal spatula (vol. i., p. 8), while nitrate of silver can be brought into contact with the hypertrophied tissue either with Schrötter's (Fig. 40, p. 179) or Andrew Smith's instrument (Fig. 41, p. 179), or with Allen's wires (p.179). Bosworth[2] has found glacial acetic acid of greater value than any other caustic, and Sajous[3] has also strongly recommended this remedy.

Instead of destroying the hypertrophied tissue, however, it may be removed by a cutting operation. For this purpose either a snare or sharp forceps may be employed. Jarvis'[4] écraseur (p. 189) is an excellent instrument, while my own (p. 190) will be found very convenient. When the anterior part of one of the turbinated bodies is enlarged, it should first be transfixed with a needle mounted in a light handle, the loop of the écraseur being then passed over the needle, and gradually drawn round the hypertrophied membrane. If the posterior extremity of the turbinated body be the part affected, such a bend should be given to the loop before it is pushed through the nose, that it will pass over the mass in the nasopharynx. Two or three turns of Jarvis's screw, or a few touches of the lever of my instrument, will suffice to secure the growth, which, if hemorrhage is anticipated, should be cut through very slowly, the operation being interrupted from time to time, and not completed for half an hour or even an hour. In these cases it will be found much more easy to re-

[1] Beverley Robinson: Practical Treatise on Nasal Catarrh, New York, 1880, p. 111.
[2] Diseases of the Throat and Nose, New York, 1881; and New York Medical Record, June 10, 1882.
[3] Med. and Surg. Reporter, December 31, 1881.
[4] New York Medical Record, 1881.

move the swollen tissue with the écraseur passed through the nose than to destroy it through the naso-pharynx. Beverley Robinson [1] has successfully removed hypertrophied tissue from the turbinated bodies by means of his strongly-toothed forceps (p. 186), but this treatment appears to be much more severe than either the electric cautery or the wire écraseur.

DRY [2] CATARRH OFTEN LEADING TO OZÆNA.

Latin Eq.—Catarrhus siccus abiens sæpe in ozænam.
French Eq.—Coryza sec conduisant souvent à l'ozène.
German Eq.—Trockener Katarrh oft in Ozæna übergehend.
Italian Eq.—Catarro secco producendo spesso l'ozena.

Definition.—Chronic inflammation of the lining membrane of the nose, in which a thin secretion, instead of flowing away, dries on the surface, giving rise to adherent brown or green flakes or crusty masses of dried mucus, which are apt to undergo decomposition and cause a disgusting and characteristic stench known under the name of ozæna. There is often atrophy of the turbinated bodies and of the subjacent bony structures, while the nasal passages and meatuses are proportionately increased in capacity.

History.—The relation of dry catarrh to ozæna has only been recognized in quite modern times, but the term *ozæna* is one of the oldest in medicine. As used by the Greek and Latin technical writers, it signified not simply a stench, but, more concretely, a foul-smelling ulcer in the interior of the nose. Pliny [4] mentions the treatment of *ozænæ* (ulcers) of the nose, and Celsus [5] quotes the Greek surgeons as applying the term to fetid sores covered with crusts. The etymological meaning of the word, however, was soon forgotten, and a century and a half after the time of Celsus we find Galen [6] speaking of two kinds of ozæna—one being simply an ulcer difficult to cure, and another where the ulcer is accompanied by a disagreeable odor. Paul of Ægina [7] defines ozæna as a "carious and putrid ulcer, produced by saturation (of the nares) with acrid humors" Ætius [8] refers to ozæna as being of the nature of an ulcer, and advises treatment by remedies applied by insufflation through a reed, or by means of medicated tents inserted in the nostrils. Alexander Trallianus, [9] in the sixth century, mentions the disease, merely, however, repeating the words of Galen. In the twelfth century, Actuarius [10] gives a clear description of the condition as arising from decomposed secretions, without mentioning ulceration as a necessary feature of the complaint. Ambroise Paré [11] contents himself with transcribing the words of Galen, merely adding

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[1] Op. cit., p. 114.

[2] Notwithstanding the recent strictures of Virchow (Address delivered before the Berlin Medical Society, January 24, 1883, Med. Press and Circ., April 11, 1883, p. 312), principally based on etymological considerations, to the term "dry catarrh," its convenience is so great that it cannot well be dispensed with. Dry catarrh means a catarrh in which the secretion is prevented from "flowing away" through its rapidly drying property. In other words, the term avoids the use of a long explanatory paraphrase.

[3] Ὀζη, a stench. Forcellini (sub voce) states that the term in its medical sense is derived from *ozæna*, a fish, "ex polyporum genere, caput habens gravissimi odoris;" but it seems more probable that the fish and the disease take their name from the same word.

[4] Hist. Nat., 25, 13, 102.
[5] De Medicinâ, lib. vi., cap. 8.
[6] De compos. pharmacorum sec locos, lib. iii., c. 3.
[7] Opera, lib. iii., c. 24.
[8] Tetrabiblos, ii. sermo. ii. cap. 90.
[9] De arte medicâ, lib. iii., cap. viii.
[10] De methodo medendi, lib. ii., c. viii.
[11] Chirurgie, liv. ii., chap. xv.

a suggestion for a remedy of which *urina asini* appears to have been the chief ingredient. In the beginning of the seventeenth century, Johannes Crato[1] anticipated in a remarkable manner the most modern doctrine as regards the nature of ozæna. His words are: "Imo in catarrhosis *pituitam putrescere*, et putridum quiddam eos expirare indicio sunt coryzæ halitu etiam contagiosæ." Fabricius ab Acquapendente[2] seems to have been familiar with the affection, which he looked upon as an ulceration of the interior of the nose, often connected with syphilis, but not at all necessarily dependent thereon. Sir Thomas Mayern[3] mentions several remedies for the disease, which he also considered as being most frequently due to venereal disorder, but in some cases proceeding "ab humoribus acribus et salsis." At the close of the seventeenth century, Vieussens[4] taught that *fœtor narium—i.e.*, ozæna in its modern sense—arises from the fermentative putrefaction which the mucous secretion is apt to undergo if it be retained too long within the nose or the adjoining sinuses. Some years later, Reininger[5] maintained that the decomposition of mucus within the ethmoidal, sphenoidal, and frontal sinuses, and the antrum of Highmore, produced almost incurable ozæna. Günz[6] published some valuable observations, chiefly of cases where the odor was due to disease of the sinuses opening into the nose. This subject, like everything else in connection with the nose, is treated of with his usual erudition by Cloquet in the work[7] already frequently referred to. Cazenave,[8] of Bordeaux, studied the complaint from a scientific point of view, as far as could be done with the imperfect means of diagnosis at his command. Trousseau,[9] while refusing to commit himself to any theory as to the origin of ozæna, described its clinical features with remarkable clearness, and his instructions for treatment were marked by his usual sound sense. A great step in advance was made by Otto Weber,[10] who pointed out that ozæna is merely a symptom, and that it would be better either to lay this term altogether aside, as only serving to conceal an incomplete diagnosis, or to retain it for those cases in which there is no trace of ulceration. In recent years, improved methods and appliances for the examination of the nose have led to a more active interest in its diseases, and a number of valuable monographs and papers have appeared on the subject of ozæna. Of these I need only mention the contributions of Schrötter,[11] Zaufal,[12] Tillot,[13] Michel,[14] B. Fränkel,[15] Rouge,[16] Gottstein,[17] Cozzolino,[18] E. Fränkel,[19] Beverley Robinson,[20] Stoerk,[21] Franks,[22] Schäffer,[23] Martin,[24] Krause,[25] and Massei.[26] The views of several of these authors will be referred to in detail in the body of the article, but I think it desirable to remark here that the theory of Crato and Vieussens, and the more precise statements of Otto Weber, attracted little or no notice; and it was not until Fränkel, of Berlin, insisted on the view that

[1] Epist. Philos. Medic., Hanoviæ, 1610, epist. cvi., p. 188.

[2] Opera chirurgica, Lugd. Batavorum, 1723, p. 444 et seq.

[3] Praxeos Mayernianæ Syntagma, Londini, 1690, vol. i., cap. xvi., p. 89; also vol. ii., p. 261 et seq

[4] De cerebro, cap. xvi.; in Leclerc and Manget's Bibliotheca Anatomica, Genevæ, 1699, t. ii., p. 159.

[5] Dissert. inaugur. de cavitatibus ossium capitis, Altorf, 1722, § xxxix., p. 31.

[6] Obs. ad ozænam maxillarum, Lipsiæ, 1753, p. viii.

[7] Osphrésiologie. Paris, 1821.

[8] De l'Ozène non-vénérienne. Paris, 1831.

[9] Clinical Medicine, Syd. Soc. Transl., 1870, vol. iii., p. 59 et seq.

[10] Von Pitha u. Billroth: Chirurgie, Bd. iii., i. Abtheil., 2 Heft, Erlangen, 1866, p. 187.

[11] Jahresbericht der Klinik für Laryngoscopie, Wien, 1881; Ibid., 1873–75.

[12] Aerzt. Correspondenzblatt, 1874, No. 33; Ibid., 1877, No. 24.

[13] Annales des Maladies de l'Oreille, etc., 1875, t. i., p. 112 et seq.

[14] Krankheiten der Nasenhöhle. Berlin, 1876.

[15] Ziemssen's Cyclopædia, 1876, vol. iv., p. 136 et seq.

[16] Compte-rendus et Mém. du Congrès des Sci. Médicales de Genève, 1877.

[17] Breslau. aerztliche Zeitschrift, September 27, 1879.

[18] Ozena, e pseudo-ozeni. Napoli, 1879. See also Ozena e sue forme cliniche, Napoli, 1881, by the same author.

[19] Virchow's Archiv, Bd. lxxv., 1 Heft, 1879.

[20] Nasal Catarrh, New York, 1880, p. 74 et seq.

[21] Laryngoscopie und Rhinoscopie. Wien, 1880.

[22] Dublin Journ. of Med. Science, June, 1881.

[23] Monatsschrift für Ohrenheilkunde, 1881, No. 4.

[24] De l'Ozène, Thèse de Paris, 1881.

[25] Virchow's Archiv, 1881; and Trans. Intern. Med. Congress, London, 1881, vol. iii.

[26] Giornale Internaz. delle Scienze Mediche, Anno iv. Napoli, 1882.

the term ozæna, if retained at all, should be confined to cases of dry catarrh, in which the decomposition of the retained secretions gives rise to an offensive smell, that a new era was established. This mode of regarding ozæna has since been followed by Beverley Robinson and Gottstein, both of whom have also made valuable suggestions as to the treatment of the complaint.

Etiology.—Dry catarrh is pretty common up to the period of middle life, but it rarely gives rise to ozæna in the case of adults ; indeed, in upward of twenty years' experience I can only recall five cases in which ozæna *commenced* after thirty. One of the patients was a lady fifty-three years old, and another a man aged fifty-seven. The other three patients were between thirty and forty. On the other hand, in the case of children and young persons, especially at the age of puberty, dry catarrh so rapidly passes into ozæna that the parched condition of the mucous membrane is often not observed till the fetor calls attention to it.

Ozæna is generally thought to be a complaint of *constitutional* origin, and those who use more precise language call it either *strumous* or *syphilitic*. Schäffer, who employs the term ozæna in a somewhat comprehensive manner, has pointed out that the countless acinous glands of the Schneiderian membrane, which are so abundantly supplied with blood through the rich cavernous structure of the spongy bodies, afford a peculiarly favorable ground for the manifestation of a dyscrasia, and he considers the complaint as always due to struma or syphilis, hereditary or acquired. He states that in 119 cases,[1] he found 99 of strumous and 20 of syphilitic origin. In two cases the complaint was distinctly due to hereditary syphilis. In one of them the patient died at the age of four months, presenting pemphigus on the soles of the feet, and ulcers at the margins of the nose together with a fetid discharge. In the second case, the symptoms commenced when the child was between five and six weeks old, and were relieved by mercurial treatment and carefully applied local remedies, which had been used without success in the other instance. Schrötter and Stoerk employ the word ozæna in its ancient vague sense, and their recorded experience must therefore be received subject to certain qualifications. Of 77 cases reported by Schrötter, syphilis was the supposed cause in 34, and scrofula in 10 ; while in the remaining cases the etiology could not be determined, except in two, which were of traumatic origin. Stoerk thinks that ozæna is always syphilitic, but that when it develops some time after birth it is often difficult to prove its hereditary origin, and that under these circumstances physicians fall back on the theory of scrofula. Of 12 cases examined by Gottstein, there were only 2 in which it appeared probable that there was any scrofulous taint, while in none was there the slightest trace of syphilis.

I do not myself consider that the disease is constitutional in the true sense of the word. Though scrofula probably produces a certain disposition to catarrh, and renders the affection more intractable when it does occur, it cannot, in my opinion, be said to cause ozæna. In adults, dry catarrh shows no special disposition to affect the strumous.

I have met with only three cases in which there was any evidence of hereditary syphilis, and I only know of three in which ozæna, *without ulceration*, has followed acquired syphilis. As, however, the disease frequently

[1] Schäffer actually reports 123 cases, but as in 4 of these there was "independent disease of bone," they do not come within my definition of ozæna. In Schäffer's cases the female sex was affected nearly half as frequently again as the male.

arises in persons otherwise apparently healthy, it is obvious that it may occur also in those who have had syphilis. Ozæna often affects several children of the same family, but it is not contagious. I have had several negative proofs of this statement, especially in the case of nurses suffering from ozæna who have lived in the same family for years without the children under their charge becoming affected.

The immediately exciting cause of dry catarrh is sometimes, no doubt, the entrance of irritating particles from the surrounding atmosphere. Any condition of the nasal orifices, such as unusual size, patency, forward direction, or absence of vibrissæ, which favors the entrance of irritating particles predisposes to dry catarrh. On the other hand, anything which prevents the expulsion of morbid secretions from the nose tends to produce the disease; especially any peculiarity of shape in the nasal chambers which hinders the free blast of air through them. Thus, bony or cartilaginous outgrowths,[1] or a deviated septum, may mechanically interfere with efficient blowing of the nose. A hole in the septum, by lessening the blast of air through each passage, also favors the retention of mucus. It will be readily understood that there must be a certain relation of size between the nasal passages and their external orifices, and that if the interior of the nose is too capacious, the blast of air may not be sufficient to clear all the parts of it. A relatively small size of the turbinated bodies may be the special disturbing influence, and Zaufal considers that ozœna is actually due to insufficient size of the spongy *bones*. His views will be again referred to in dealing with the pathology of this disease.

The precise conditions which cause the secretion to dry and become adherent to the mucous membrane are unknown; but the process is probably due to some chemical change in the liquid itself. It has been shown by Ranvier[2] that in acute coryza the ciliated epithelial cells are shed very abundantly, and it is possible, as suggested by Solis-Cohen,[3] that the deficiency of the ciliary element in the nasal passages thus brought about may lead to the stagnation of the secretion upon the membrane, and consequently to the formation of dry crusts upon its surface. Fränkel[4] considers that the drying of the secretion is due to its richness in cells and comparative deficiency in water, and that the desiccation is further promoted by the patient failing to clear his nose sufficiently. He suggests, moreover, that in these cases there may be diminished reflex irritability, and possibly impairment of the activity of the cilia.

How it is that in some cases the retained secretions give rise to ozæna and not in others has not yet been determined. It may be that in some instances the mucus, though dry, does not remain long enough *in situ* to decompose, or the stench may, as first suggested by Vieussens, and subsequently by Fränkel, depend on some fermentative change which occurs in certain cases and not in others. In his more recent contribution to this subject, Fränkel appears to have given up this idea, and attributes the smell entirely to decomposition. I am still, however, inclined to accept his earlier explanation, for the smell seems to me to be produced too quickly to be the result of simple putrefaction. Thus, if a person suffer-

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[1] Those hard tumors which give rise to *ulceration* introduce an entirely new element into the subject, and take the case out of the category of true ozæna. Soft growths, such as polypi, generally cause an increase of secretion, which, as the irritation is constant, does not become dry.

[2] Lancet, 1874, vol. i., p. 687.

[3] Med. News and Library, October, 1879.

[4] Ziemssen's Cyclopædia, vol. iv., p. 138.

ing from ozæna has the nares thoroughly cleansed by a detergent spray the stench often only ceases for a few hours, returning within so short a period that though fermentation might have occurred, there would not have been time for true decomposition. Franks and Krause are of opinion that the smell is due to a fatty degeneration of the mucous cells, the fatty material subsequently becoming acid (see Pathology).

It has been thought by some that the peculiar smell is not developed unless there be real atrophy of the minute glands of the submucous tissues lining the nasal cavities. That atrophy commonly exists cannot be denied, but it is not a universal law; at least I may say that I have seen several cases of ozæna in which no atrophy could be detected. Gottstein,[1] who has generally found atrophy, has also reported one case in which ozæna occurred with hypertrophy; but it must be borne in mind that limited atrophy might easily have coexisted in some situation not accessible to view, both in this case and in those observed by myself.

Michel, arriving independently at the same opinion as Reininger, contends that the complaint is due to chronic suppurative inflammation of the sphenoidal and ethmoidal cells, and that the discharge from these cavities reaching the mucous membrane of the nose forms the characteristic crusts. Though in some rare cases this may occur, it is no doubt very uncommon, and has not been found to exist in the post-mortem examinations which have been made by Hartmann,[2] Krause,[3] and Gottstein (see Pathology). Massei believes that the peculiar odor depends on some specific transformation of the products of secretion, and that this alteration, probably due to some chemical change in the mucin, only takes place at the moment that the mucus passes through the epithelium. This view is, to say the least of it, somewhat speculative.

While it has appeared desirable to refer to the theories of some of the recent workers in rhinology, much difficulty still surrounds the subject, owing to the fact that the term ozæna continues to be applied to totally different affections. Diseased bone, fetid ulcers, decomposed secretion, all give rise to a stinking odor, but there can be little advantage in bringing together such a variety of affections merely because they have one symptom in common. Moreover, and particularly as showing the inconvenience of thus classifying these conditions together, it may be mentioned that the stench in each of these cases is quite different. The smell of diseased bone in the nose is the same as that generated by dead bone elsewhere, but in the former situation it appears somewhat stronger, because its source is generally nearer to the bystander, and also because it is constantly diffused by expiration; but it is difficult to discover any advantage in describing the odor of dead bone in the nose by the name of ozæna. I entirely agree with Fränkel,[4] therefore, that if the term be retained, its application should be limited to those cases in which, in the absence of ulceration and diseased bone, the odor depends on changes in the retained secretions.

Symptoms.—The subjective symptoms of *dry catarrh* vary according to the site and intensity of the disorder. When the affection is limited to the anterior portion of the nasal channels, as a rule it causes but little inconvenience, the patient merely feeling a slight itching sensation, and a desire to blow the nose. In bad cases, however, the irritation is so great

[1] Breslau. aerzt. Zeitschrift, September, 1873.
[2] Deutsche med. Wochenschrift, 1878, No. 13.
[3] Trans. Intern. Med. Congress, London, 1881, vol. iii., p. 311 et seq.
[4] Ziemssen's Cyclopædia, vol. iv., p. 138.

that the patient cannot restrain himself from scratching and picking the mucous membrane, the annoyance being chiefly felt over the septum. Under these circumstances the patient will often pick the nose to such an extent as to produce ulcers, and several cases have come under my notice in which perforation of the septum has been produced in this way.

On examining the nose from the front, the observer is generally struck by the extreme roominess of its interior, and by the small size of the turbinated bodies. Indeed, in old cases the nasal canal is so large that on simply expanding the alæ with a speculum, not only the posterior wall of the pharynx, but even the orifice of the Eustachian tube, may be visible. Crusts of yellowish-gray or brown mucus may be noticed adhering to the septum and turbinated bodies. On cleansing the nose with a detergent spray, the mucous membrane is seen to be considerably congested, but if the part be examined twenty minutes or half an hour later, the membrane, though swollen, is generally pale. Sometimes the membrane bleeds slightly when the crusts are removed, and occasionally, though very rarely, the dried mucus adheres to the surface of superficial ulcers. It is important, however, to bear in mind that ulceration is a purely accidental complication, and in no way essential to the complaint.

The symptoms of *ozæna* are the same as those which have just been described as belonging to dry catarrh, but there is, in addition, a peculiar fetor. In the ordinary form of ozæna the thin flakes of dried secretion already described are met with, but in some cases round or oval lumps from two to three centimetres in length, and from one to two centimetres in width, are slowly formed and expelled at intervals of a week or ten days. These masses are generally of a dirty white or green color, but they may be brown or even black, their color depending on the length of time the secretion has been retained, and on accidental circumstances, such as discoloration by carbon in the air, or by slight accidental bleeding.[1] They are of somewhat dense structure, moist externally, but dry and very compact in the centre. When they attain a certain size, it would seem that by pressing on the mucous membrane, they excite a liquid secretion, which facilitates their expulsion. These masses, when they form in the nose, generally collect in its vault in the neighborhood of the superior turbinated body, but they sometimes accumulate in the naso-pharynx.

It would be no doubt desirable, if possible, to describe the stench of ozæna, but I know of no way in which an odor can be described except by comparing it with some other smell, and in this instance there is no stench to which it bears the faintest resemblance.[2]

Diagnosis.—It is very important to distinguish true ozæna—*i.e.*, dry catarrh with fetid secretions—from cases in which there is ulceration of the

[1] An extraordinary case is related by Gallway (Lancet, October 15, 1859), in which a lady occasionally blew out of her nose a black sooty powder, dry, and insoluble in water. This occurred five times in the course of nine months, and was not accompanied by pain or uneasiness of any kind. The patient had not used charcoal in any way. It may be stated that she was a woman of nervous temperament, from thirty-five to forty years of age.

[2] The French call the complaint *punaisie*, in addition to the equivalent term placed at the head of this article, and some writers affirm that this word is derived from *punaise*, the common bed-bug, and that the stench of ozæna resembles that caused by the crushed insect. But there is in fact no resemblance between the smells, and the two words *punaise* and *punaisie* are simply derived from the same source, *puer*, to stink (adj. *punais*). Any person who has once perceived the characteristic odor of ozæna will always readily recognize it again.

mucous membrane or disease of the bones. Careful examination with the speculum will usually enable the observer to detect any morbid alteration in the skeleton, but Eugene Fränkel has shown that in some cases the necrosis may be so slight as to escape observation during life. Washing out the nose with a detergent spray will generally completely remove the smell, if the case is one of true ozæna, but if there is diseased bone the stench, though milder, can still be detected. Fetid discharges occur in cancer of the nose, in tubercular disease of the pituitary membrane, and in lupus exedens of the Schneiderian membrane ; but these diseases are happily all rare, and a knowledge of their distinctive features will prevent the practitioner confusing them with simple ozæna. In all cases in which there is an offensive smell a careful search should be made for a foreign body, instances having often occurred in which such a condition has simulated ozæna. A very remarkable example has been reported by Tillaux,[1] where a cherry-stone impacted in the nasal cavity gave rise to an odor resembling ozæna, which disappeared on removal of the stone two years after the date of its introduction. Cases are also related by Holmes Coote[2] in which a fetid discharge from the nose was found to depend on the presence, in one instance, of a plum-stone, and in another of a boot-button. On their removal the discharge from the nose at once ceased.

Pathology.—The changes occurring in dry catarrh and ozæna have been considered, to some extent, in dealing with the etiology. Atrophy appears to be always a secondary affection, or, in other words, the changes are of a quasi-cirrhotic character, resulting from previous inflammatory thickening. The recent investigations of Zuckerkandl[3] prove that not only the soft tissues, but also the bony structure of the turbinated body becomes thinner, more elastic, flatter, and smaller. The mucous membrane shrinks and becomes wrinkled, the erectile tissue disappears, and the thin, pale, shining mucosa looks more like serous than mucous membrane. When the morbid process is far advanced, nothing is left but thin bands of mucous membrane, occasionally, perhaps, containing some small osseous fragments—the remains of the spongy bones. Schäffer, who, in some cases, has been able to watch the whole process, found the hypertrophic stage last from eight to ten years before any wasting set in. No doubt, however, the disease sometimes passes through its various phases much more rapidly, and I have occasionally seen the atrophic condition reached in the course of a few months. Bayer,[4] of Brussels, has observed hypertrophy in the children of patients who have themselves arrived at the atrophic stage. Both Schäffer and Ziem[5] maintain that ozæna may exist without atrophy, and there is no doubt that atrophy may occur without ozæna. I have already (see Etiology) stated my own experience as regards this matter, but may add here that I recently saw a girl, aged eighteen, in whom there was marked atrophy of the turbinated bones with corresponding enlargement of the nasal channels, but without the least trace of ozæna. Yet the patient assured me that the symptoms of dry catarrh had existed since she was four or five years old.

Gottstein[6] has reported a case in which he made an autopsy on a pa-

[1] Bull. de la Soc. de Chir., January 26, 1876.

[2] Holmes' System of Surgery, London, 1870, Second Edition, vol. ii., pp. 423, 424.

[3] Normale und pathol. Anatomie der Nasenhöhle, Wien, 1882, p. 87 et seq.

[4] Trans. Intern. Med. Congress, London, 1881, vol. iii., p. 314.

[5] Monatsschrift für Ohrenheilkunde, 1880, No. 4.

[6] Breslauer ärztliche Zeitschrift, September, 1879, Nos 17 and 18, p. 6.

tient who had suffered from ozæna. The subject was a young woman, twenty-four years old, afflicted with insanity, who died of caseous pneumonia. During life Gottstein observed that the nasal passages were extremely wide, and after the removal of a quantity of stinking crusts, the mucous membrane was seen to be pale, thin, and free from ulceration. At the post-mortem examination the bones and cartilages, unfortunately, could not be examined; but the mucous membrane, so far as it was accessible by very careful examination, showed no defect, except a certain thinness. On microscopic investigation the epithelium was found to be normal; beneath this there was a layer of small round cells mixed with a few spindle-shaped cells, and beneath this stratum again was another of fibrillar areolar tissue generally lying parallel to the surface, the fibrillæ being here and there collected into bundles in different stages of development. The vessels were richly developed, and the elastic tunic of the arteries thickened. The glandulæ were numerous; their contents were hazy and infiltrated, the gland-cells not being recognizable in some places, while in others they were misshapen and scarcely discernible. As Gottstein[1] remarks, "the appearances were those of chronic rhinitis, with more or less advanced cirrhosis of the mucous membrane, and a partly infiltrated and atrophied condition of the glandulæ." Krause[2] found a horny condition of the epithelium, atrophy of the mucosa, and degeneration of that structure into a kind of dense connective tissue, diminution in the number of blood-vessels, more or less obliteration of those that remained, through thickening of the *adventitia* and puckering of the *intima*. He found the glandulæ generally deficient, and those that were left showed fatty or granular degeneration. Zaufal[3] is of opinion that the diminutive volume of the osseous structures is not due to atrophy, but to their retaining their infantile dimensions, while the face in general undergoes its normal development.[4] This, according to Zaufal, explains the frequent occurrence of ozæna at puberty, when the arrest of development suddenly becomes manifest, owing to the maturation of the contiguous parts. The theory of non-development has, however, recently been ably combated by Zuckerkandl,[5] who, in examining 252 skulls of young subjects, met with only one in which the turbinated bones were of insufficient size, and in this case there was a clear history of atrophy having taken place.

The mucus of ozæna has been made the subject of investigation by several physicians. Frank[6] repeatedly examined fresh specimens from the nares of Michel's patients suffering from ozæna, but he never found anything more than pus-corpuscles, granular *débris*, and some traces of epithelium. On the other hand, Krause[7] maintains that the newly formed mucous cells undergo fatty degeneration before they are detached from the surface of the pituitary membrane, rendering the secretion viscid, and disposed to fetid change. He observed that in the membrane thus degenerated, well-formed cells are not found, but in their place collections of fatty corpuscles and pigmentary molecules, which constitute the dried mucus of the adherent crusts. Subsequently the fatty matter becomes

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[1] Breslauer ärztliche Zeitschrift, September, 1879, Nos. 17 and 18, p. 6.

[2] Virchow's Archiv. f. path. Anat., Bd. lxxxv., Hft. 2.

[3] Loc. cit.

[4] A supposed case of non-development of the turbinated bones had been previously recorded by Hyrtl (Sitzungsber. d. kk. Akad. in Wien, Bd. xxxviii.), but it was not reported as bearing on the question of ozæna.

[5] Op. cit., p. 90.

[6] Michel: Krankheiten der Nasenhöhle, Berlin, 1876, p. 107.

[7] Trans. Intern. Med. Congress, London, 1881, vol. iii., p. 311 et seq.

acid, and gives rise to the characteristic odor of ozæna. This view, however, is not borne out by the observations of Eugene Fränkel,[1] who found no fat in three cases of undoubted ozæna which he had an opportunity of examining after death.

Prognosis.—Dry catarrh is always a very obstinate affection, while true ozæna is rarely, if ever, cured, except in the case of young children, in whom the disease sometimes passes away after it has existed for a few weeks. Ozæna can, however, be so completely kept in check by the treatment hereafter recommended, that it practically causes no inconvenience beyond the necessity of using a detergent wash or spray once or twice a day, or a tampon for a few hours daily. The stench diminishes in intensity as age advances, and about fifty generally ceases altogether.

Treatment.—In dry catarrh and ozæna the first step is to get rid of the crusts. This may be done by washing, douching, syringing, or spraying the nasal fossæ (see Nasal Instruments, pp. 179–184).

The best solutions for washes and douches are the Collunarium sodæ, the C. acidi carbolici, the C. acidi carbolici cum sodâ et borace, or the C. potassæ permanganatis of the Throat Hospital Pharmacopœia, the formulæ for which will be found in the Appendix. As a rule I prefer washes, as I find them much less disagreeable to the patient, and generally quite as efficient in their action. But when the crusts form in the vault of the nose both washes and douches fail. Here sprays will often be successful, but sometimes the simple spray-apparatus (see Figs. 44, 45, and 46), does not act with sufficient force, and if this be the case a pneumatic spray-producer (Fig. 47) should be employed. Any of the alkaline or disinfectant sprays of the Throat Hospital Pharmacopœia (see Appendix), answer the purpose well. If the spray be used in the morning and afternoon, it will entirely get rid of any smell, and generally after a few months it will be found sufficient to use it only once a day—in the morning. Resorcin, a derivative of phenol, allied to carbolic acid, but without its irritating properties or its offensive smell, has recently been tried by Masini,[2] who reports very favorably of its use in cases of ozæna. He first gets rid of the crusts on the nasal mucous membrane by means of douching, and then employs sprays of a watery solution of ½ per cent. of resorcin, applied twice a day during three or four minutes. The medicament may also be painted over the diseased surface in the form of a pomade, consisting of 30 decigrammes of resorcin to 10 grammes of vaseline. Massei[3] asserts that in some cases ozæna may be radically cured by means of resorcin; he prefers, however, to use it in the form of douche—2 grammes in 600 of water—rather than spray.

Gottstein has introduced an entirely novel mode of treatment. Noticing that it is only the *dried* mucus which smells, he has devised an ingenious arrangement for keeping the secretion *moist*. This consists in introducing a tampon of cotton-wool into the nasal passage, the contact of which with the mucous membrane causes a slight but constant flow of mucus. The tampon is easily introduced by means of a screw (see Fig. 73, p. 196), and need only be retained for a couple of hours in the morning on one side, and for the same length of time on the other side in the afternoon; occasionally, indeed, a shorter period will suffice. Should this method not succeed at first, it shows that the pledget of wool is not large

[1] Trans Intern. Med. Congress, London, 1881, vol. iii., p. 313.
[2] Archivii Italiani di Laringologia, Anno ii., 1882, October 15, pp. 74–77.
[3] Ibid., April 15, 1883, pp. 26–28.

enough. It is necessary, in fact, that it should be in thorough apposition to the mucous membrane. Several of my patients have worn these tampons for the last two or three years, not only without complaint, but with the greatest gratitude. It will be observed that this treatment is purely mechanical, but Woakes[1] has found *medicated* wools still more effectual, and a number of these are given in the Appendix.

The remedies which have hitherto been considered are of a palliative nature, but it is not surprising that in a complaint of so intractable and disgusting a character, a great many attempts should have been made to find a radical cure. Nor is it at all remarkable that iodoform should have been much vaunted. I have used this remedy in powder, dissolved in ether as a spray, and also in the form of a nasal bougie. I cannot say, however, that I have found it more effectual than simple alkaline and detergent lotions, while it labors under the disadvantage of causing an odor which, if less disgusting than that of ozæna, is certainly very penetrating. Remedies which stimulate the mucous membrane certainly do good, and sometimes permit the cleansing process to be carried out at longer intervals, though it cannot be dispensed with altogether. The red gum diluted with starch (1 part of gum to 2 of starch) has seemed to me the most useful of all these; but Bosworth[2] speaks most highly of sanguinaria (1 part to 3 of starch), and galanga (equal parts of the powdered root and starch). These powders should be blown into the nose after it has been washed out with a detergent spray. Galanga and sanguinaria somewhat resemble eucalyptus in their action, but are much more irritating. If employed at all, I should advise them to be used in a considerably more dilute form than that recommended by Bosworth.

The application of white heat to the mucous membrane, with the view of destroying the suppurating surface, has been advocated by Bernard Fränkel, but I have not had sufficient experience of this method of treatment to be able to speak with any confidence on the subject. I may state, however, that in three cases in which crusts have formed quite at the anterior part of the nose, a few applications of electric cautery so altered the character of the mucous membrane that the morbid process was entirely arrested.

CHRONIC BLENNORRHŒA OF THE NOSE AND AIR-PASSAGES.

A somewhat rare form of purulent rhinitis has been described by Stoerk,[3] under the name of chronic blennorrhœa of the mucous membrane of the nose, larynx, and trachea. He says that this condition is common among the Polish Jews in Gallicia, Poland, Wallachia, and Bessarabia. Most of the patients seen by him were poor, and attached little importance to personal cleanliness. According to Stoerk's account, in the first stage of this ailment there is a profuse secretion from the nose of more or less purulent greenish-yellow fluid, while the absence of the vascular injection and succulence generally met with in acute catarrh should prevent blennorrhœa from being confounded with coryza. The disease shows a marked disposition to extend through the pharynx to the larynx and even the

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[1] Lancet, 1880, vol. i., p. 876.
[2] Op. cit , pp. 216, 217.
[3] Krankheiten des Kehlkopfs, Stuttgart, 1880, p. 161.

trachea. In the nose the cartilages and bones are never involved, and the nasal affection itself is of little importance, except in so far as it is the starting-point of serious disease which ultimately invades the respiratory passages. In the larynx, the ulceration frequently commences at the stalk of the epiglottis, and this spreads down into the larynx, involving the edges of the vocal cords near the anterior commissure, and often leading ultimately to adhesion between the two cords. In this way the glottis is reduced to a small crescentic opening, the concavity of the crescent being directed backward. A web is likewise frequently formed in the larynx below the level of the vocal cords, and the disease often involves the wall of the trachea and may even extend to the minute bronchial tubes, where it occasionally gives rise to hæmoptysis. No treatment is of much avail, but tracheotomy has been performed with temporary benefit, and in some rare cases the induration has spontaneously disappeared.

BLEEDING FROM THE NOSE.

(Synonym : Epistaxis.)

Latin Eq.—Hæmorrhagia narium. Epistaxis.
French Eq.—Saignement du nez. Epistaxis.
German Eq.—Nasenbluten.
Italian Eq.—Epistassi.

Definition.—Hemorrhage from the nose, originating either in the nasal cavity proper or in the sinuses communicating with it.

History.—Bleeding from the nose was considered by the old physicians as a symptom of more valuable import than modern practitioners usually accord to it. It is referred to by Hippocrates [1] as indicating a favorable crisis in acute fevers, or as being ominous of a fatal result in certain chronic diseases. He was also acquainted [2] with the frequent connection of hemorrhage from the nose with enlargement of the spleen, and other abdominal viscera, and with its occasional vicarious occurrence in cases of suppressed menstruation.[3] Galen [4] considered it as a natural relief to vascular tension in fevers, and he mentions a case in which he was able to predict a flow of blood from one nostril in the course of an acute fever, accompanied by delirium. He recommended [5] that epistaxis should be stopped by squeezing the nose tightly with the fingers, or, if this failed, by pushing a pledget of lint or a piece of dry sponge as far into the nostril as possible. Aretæus [6] regarded nasal hemorrhage as indicative of resolution in acute pleurisy; and he advised that, for the relief of headache, bleeding from the nose should be artificially induced by means of instruments devised for the purpose.[7] It may, indeed, be gathered from the writings of Paul of Ægina,[8] that this was a common therapeutic measure among the ancients. In the seventeenth century Fabricius Hildanus [9] related many cases of bleeding from the nose which he had treated generally with a styptic powder of his own invention. Not long after, Sydenham,[10] while expressing a great contempt for local hæmostatics, urged that blood-letting was the true principle on which

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[1] Epidemiorum, lib. i.
[2] Prorrheticorum, lib. i., cap. viii.
[3] Aphorism, sect. 5.
[4] De crisibus.
[5] De compos. pharm. sec. locos., lib. iii., ch. iv.
[6] On the Causes and Symptoms of Acute Diseases. Bk. i., ch. ix. Syd. Soc. Transl.
[7] On the Treatment of Chronic Diseases, Bk. i., ch. ii. Syd. Soc. Transl.
[8] Works, Syd. Soc. Transl., vol. i., p. 326.
[9] Opera Observ. et curat. medico-chirug. quæ extant omnia. Francofurti, 1682.
[10] Med. Observ., ch. iv, 48 and 49; and Processus Integri, ch. xlv.

epistaxis should be treated. In the eighteenth century, the celebrated Hoffmann[1] devoted a chapter of considerable length to the subject of nasal hemorrhage; while Morgagni,[2] though referring to the affection very briefly, quotes an observation of Valsalva as to the immediate source of the bleeding in many cases, which is of great practical importance, and which will be cited further on. To Bellocq[3] we owe the extremely valuable invention for plugging the posterior nares which bears his name. Nasal hemorrhage was classed by the nosologists of last century as a substantive disease, and the term "epistaxis," used by the older writers for every kind of hemorrhage occurring drop by drop, was first proposed by Vogel[4] to be confined to bleeding from the nose. This term was subsequently adopted by Cullen[5] and Pinel,[6] and soon came into general use. In the early part of the present century J. P. Frank[7] treated the subject with great fulness, and with much practical sense. He arrested bleeding by pushing into the nostril a piece of dried hog's intestine, tied at one end so as to form a pouch like the finger of a glove, and distending this by injecting water with a syringe, the proximal end of the gut being then tied and the plug left in position as long as required. This simple appliance has been frequently imitated since in more elaborate forms. A lengthy chapter, full of curious, but somewhat undigested, erudition concerning epistaxis, or hæmorrhinia, as he preferred to call it, will be found in Cloquet's[8] work, which has been already referred to several times in this volume. Some valuable remarks on epistaxis, especially as regards its connection with other hemorrhages, were made by Laycock[9] in 1862, and in the same year Rawdon Macnamara[10] published an elaborate article which embodied the results of an unusually large experience of the complaint, and contained many useful suggestions as to treatment.

Etiology.—Epistaxis is decidedly more common in men than in women, possibly, as suggested by Hoffmann,[11] because in the case of the latter there is a periodical depletion by the monthly discharge. It is also more frequent in childhood and old age, than in the prime of life; the bleeding, as will presently be shown, being usually due to plethora in the child, and to degenerative changes in the vascular system in the old. The period of life at which nasal hemorrhage is absolutely most frequent is probably about the time of puberty. The causes may be local or constitutional. Among the former the most frequent is direct violence from blows or falls, but sneezing or blowing the nose will often cause bleeding. "Picking" the nose is a common cause of epistaxis in young persons, while the introduction of foreign bodies, such as a piece of wood or slate-pencil, has sometimes led to severe hemorrhage in children. In the same way, troublesome bleeding occasionally occurs from the passing of nasal bougies. If there be any ulceration of the nasal mucous membrane a very slight strain may cause blood to flow from the nose. Fibrous tumors of the naso-pharynx and malignant growths are especially apt to induce epistaxis. Irritant particles in the air, such as arise from strong ammonia, jalap, and ipecac-

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[1] Medicinæ Ration. System., Pars. Secund., sect. prima, c. i.; Hoffmann's Op. omnia Physico-medica, p. 196 et seq. Genevæ, 1740.

[2] De sedibus et causis morborum, epist. xiv., Art. 23. Patavii, 1765.

[3] I have not been able to find the exact date of the invention of this instrument, but it certainly was in use at the commencement of the present century, for it is mentioned by Deschamps in his thesis Des Maladies des Fosses nasales, which bears date 1804.

[4] Definitio generum morborum. Gottingæ, 1764. The term ἐπιστάξις was used by Hippocrates to signify bleeding drop by drop, but was not applied especially to hemorrhage from the nose.

[5] Synopsis nosologiæ medicæ, Edinburgi, 1785, Ed. Quart.

[6] Nosographie philosophique, Paris, 1818, 6me éd., t. ii., p. 589.

[7] De curandis hominum morbis, Mannhemii, 1807, lib. v., pars. 2, p. 124 et seq.

[8] Osphrésiologie. Paris, 1821.

[9] Lectures on the Physiognomical Diagnosis of Disease. Med. Times and Gaz., 1862, vol. i., p. 501.

[10] Dublin Quarterly Journ. of Med. Science, 1862, vol. xxxiii., p. 43 et seq.

[11] Op. cit.

uanha, when drawn into the nose in breathing, often cause hemorrhage from the nasal mucous membrane, and strong snuff has also been known to produce this effect.[1] Some curious indiosyncrasies are recorded of epistaxis being brought on by extraordinary causes. One of the most remarkable of these is the case of John a Querceto, a secretary of Francis I., who is stated, on good authority,[2] to have bled at the nose if he smelt an apple.

Constitutional causes are of four kinds: First, the blood itself may be altered in constitution; secondly, the vessels may be diseased; thirdly, there may be obstruction to the circulation through the lungs, liver, kidneys, or other organs, causing a sudden tension or strain of the whole system, which gives way at a weak part, viz., the nose, where the vessels are very superficial and their arrangement is in places cavernous (see Anatomy, p. 164); fourthly, the blood-flow may be a vicarious discharge.

(1.) The most common cause of bleeding under this head is the hemorrhage diathesis, or hæmophilia, the nose being the part from which the flow most frequently takes place in such cases. Laycock[3] found that out of 227 "bleeders" the source of the hemorrhage was the nose in no fewer than 110, while in many of these cases epistaxis alternated with hæmoptysis, hæmatemesis, and hæmaturia. In all anæmic conditions of the system epistaxis is apt to occur. Out of 81 cases of leucæmia collected by Mosler[4] there was hemorrhage in 64 instances, and in 35 of these the blood came from the nose.

When the blood is abnormally abundant, as in plethoric children, hemorrhage from the nose is not unfrequent, being often preceded by a sensation of fulness in the head scarcely amounting to headache. Owing to the intercommunication between the veins of the nose and the sinuses of the dura mater, epistaxis often gives great relief in these cases.

In eruptive and relapsing fevers, bleeding from the nose is by no means an uncommon symptom. In a severe epidemic of relapsing fever occurring in Berlin in 1871–72, which was carefully studied by Felix Semon[5] in the Charité Hospital, epistaxis was a critical symptom in more than thirty per cent. of the causes, In two instances the hemorrhage continued for two or three days, and in the case of one extremely exhausted patient it was the actual cause of death. In scurvy it is usually stated to be very common. J. P. Frank[6] goes so far as to assert that in his own experience it has occasionally been the only symptom of this disease, and he looked upon epistaxis as of the highest diagnostic importance in relation to scurvy when taken in conjunction with the previous history of the patient. I am informed, however, by Mr. Johnson Smith,[7] who has had the amplest opportunity for observation during a connection of fourteen years with the Dreadnought Hospital, that in his experience epistaxis is by no means a frequent feature in scurvy. In purpura, however, nasal hemorrhage sometimes takes place. A remarkable case occurred in my own practice a few years ago. The patient, a middle-aged man, had lived for many years in the tropics, and had lately returned home in bad health. He was first attacked with hemorrhage from the larynx. This yielded after a time to spray inhalations of tannin, but the arrest of the laryngeal bleeding was followed almost immediately by such severe epistaxis that the posterior

[1] Macnamara: Loc. cit., p. 30.
[2] Bruyerinus: De re cibariâ, Francofurti, 1600, lib. xi., cap. xvi., p. 468.
[3] Loc. cit.
[4] Leukæmie. Berlin, 1872.
[5] Zur Recurrens-Epidemie in Berlin, 1871–72, Inaug.-Dissert., 1873.
[6] Op. cit., p. 135 et seq.
[7] Private communication, dated December 23, 1881.

nares had to be plugged. After two days alarming hemorrhage came on from the lungs, and Dr. Walshe saw the patient with me. Under the use of large doses of ergot the hæmoptysis ceased, but thirty-six hours later the patient died from sanguineous apoplexy.

Both in acute yellow atrophy of the liver and in phosporous poisoning, the general symptoms and morbid anatomy of which bear so singular a resemblance to each other, a rapid softening and fatty degeneration of the walls of the vessels take place, and under these circumstances epistaxis is not uncommon.

(2.) When the vessels have undergone atheromatous change, hemorrhage from the nose is not unfrequent. This is, of course, most often met with in elderly persons, but it may also occur in younger persons who have suffered from constitutional syphilis or chronic alcoholism.

(3.) The effect of strain on the vascular system is seen even in healthy persons after violent exertion, such as lifting heavy weights, violent coughing, retching, or running.[1]

This cause of nasal hemorrhage is likely to be intensified if there be at the same time any artificial obstruction to the return of the blood through the jugular veins. Epistaxis accordingly often occurred in the old days when tight stocks were worn. The same effect is sometimes produced by tumors in the neck, especially goitres. Venous obstruction from engorgement of the right side of the heart, emphysema, or severe chronic bronchitis, sometimes causes epistaxis. Diseases of the liver, kidney, and spleen are also frequently complicated by troublesome nasal hemorrhage. Strong emotion[2] sometimes gives rise to hemorrhage from the nose, the immediate cause probably being sudden tension of the vascular system, which gives way at the point of least resistance. A striking example of epistaxis from rage is related by Macnamara of a young man, whom profuse nasal hemorrhage seems to have saved from an impending fit of apoplexy. It is more difficult to explain another case reported by the same writer, in which a girl was brought to the verge of death by bleeding from the nose, which she attributed to grief for the death of her father.

(4.) Epistaxis sometimes occurs vicariously, taking the place of the menstrual flow in women, or of some periodical escape of blood from enlarged veins in the rectum, leg, or elsewhere. Fränkel[3] has collected a number of interesting examples of vicarious bleeding from the nose. In one of these (Fricker's case) a girl, who had never menstruated, suffered at intervals of six weeks from such profuse nasal hemorrhage, accompanied by menstrual molimina, that she finally died from exhaustion. In another (Sommer's case), a woman on one occasion, during the entire period of gestation, had a discharge of blood from the nose regularly once a month. In a third instance (Obermeier's case), epistaxis appears to have entirely

[1] In the horse, epistaxis caused by strain may sometimes be observed on the race-course and in the hunting-field. Mr. Doyle (Macnamara, loc. cit.), a veterinary surgeon, speaks of two fatal cases of epistaxis in horses, and mentions a celebrated racer which never ran without bleeding from the nose.

[2] Loc cit., p. 32. The curious case related by Hildanus (op. cit., cent. ii., obs. xvii.) of a plethoric, newly married young man, who was seized with furious bleeding from the nose immediately after coition, perhaps comes under this head, but the etiology is complicated by the fact that the patient had been exposed for some time to a burning sun. The peculiar effect of great mental emotion in producing epistaxis did not escape the notice of Dickens, who, in Our Mutual Friend, speaks of a spontaneous gush of blood from the nose of Bradley Headstone, when pursuing Eugene Wrayburn with the intention of murdering him.

[3] Ziemssen's Cyclopædia, vol. iv., p. 152.

taken the place of the normal uterine hemorrhage in a young woman; it came on at regular intervals of four weeks, with the usual constitutional symptoms, ceased during pregnancy, and recurred after delivery. In some of Mosler's cases of leucæmia, already referred to, the epistaxis was more or less menstrual in character. Puech [4] also gives several instances of catamenial epistaxis. Hoffmann [2] relates a case of somewhat analogous nature in which the lochial discharge was suppressed very shortly after parturition, and the patient died of epistaxis. An instance is recorded by Fabricius Hildanus [3] in which epistaxis appeared to take the place of a periodical hemorrhage from varicose veins of the leg in an old man, the flow continuing for twenty-four hours, and leaving the patient prostrate for months afterward. Bleeding at the nose is sometimes hereditary, a fact which was known to Hoffmann,[4] and of which a striking example has been recorded by Babington.[5] Of six female children of a woman who was very subject to epistaxis, three suffered from this form of hemorrhage. One of these had two daughters with the same tendency, the elder of whom had afterward a son who also inherited the peculiarity. The authenticity of the case is vouched for by the fact that Babington himself was acquainted with the mother, daughter, and grandchild. It has been asserted that the disease occurs epidemically, and in proof of this an example referred to by Morgagni [6] is brought forward. This epidemic is supposed to have occurred in Italy in the year 1200, and it is stated to have proved fatal to an immense number of persons within twenty-four hours.[7] It is probable, however, that the violent hemorrhage was only an early symptom of an epidemic fever.

Symptoms.—There is little to be said under this head, except as to the mode in which the hemorrhage occurs, and the amount of blood lost. It may be remarked, however, that certain prodromata are often present, especially in plethoric persons and in those suffering from fevers. These signs consist of a feeling of fulness in the frontal region, flushing of the face, throbbing of the temporal and carotid arteries, buzzing of the ears, giddiness, and a sensation of itching in the nose. According to Hippocrates,[8] there is also abdominal distention, an observation confirmed by Pinel,[9] who adds that "goose-skin" and coldness of the extremities are likewise often premonitory of epistaxis. The hemorrhage usually takes place drop by drop, and from this fact the modern scientific name, as already shown (see History), is derived; but sometimes the blood flows so copiously that it might be supposed that a large vessel had given way. The bleeding generally comes from one nostril, and it is only when there is some great alteration of the blood, as in fevers or allied conditions, that the flow is bilateral. Occasionally, however, the blood escaping from one nasal passage may find its way round the septum posteriorly, and issue from the other nostril, a phenomenon probably due to the formation of clots at the back of the nose. The blood is of bright red color, and the quantity lost varies usually from two or three drachms to an ounce, though sometimes much more considerable. Thus Martineau [10] relates a case in which the bleeding is said to have amounted to twelve pounds in sixty

[1] Gazette des Hôpitaux, 1863, p. 188.
[2] Op. cit., p. 200.
[3] Op. cit., cent. ii., obs. xvi.
[4] Op. cit., p. 198.
[5] Lancet, 1865, vol. ii., p. 362.
[6] Op. cit., epist. xiv., sec. 26.
[7] Gillchrist is referred to by Cloquet (op. cit., p. 557) as the authority for another supposed epidemic of epistaxis, but I have been unable to find the original report by Gillchrist, or any particulars of such an outbreak.
[8] Epidemiorum, lib. i.
[9] Op. cit., p. 591.
[10] Union Médicale, 1868, 3me série, t. vi., p. 330.

hours; while, in another instance, it is affirmed [1] that seventy-five pounds of blood trickled away in the course of ten days. In a case related by Rhodius,[2] a young man is stated to have lost eighteen pounds in thirty-six hours; and Hildanus [3] reports an extraordinary instance of a man, who, besides losing several pounds of blood from his nose, in the course of a few hours afterward vomited twenty-seven pounds which had flowed from the posterior nares, and coagulated in his stomach. There can be little doubt, however, that some of these statements are grossly exaggerated. The hemorrhage sometimes gives rise to very alarming symptoms, and the patient may pass into a state of dangerous syncope; or, if the epistaxis occur frequently, it may cause systemic anæmia of a very serious character.

Pathology.—The exposed position of the nose, and the peculiar cavernous arrangement of the vessels of the turbinated bodies, not less than the thinness of the mucous membrane covering those structures, fully explain the frequency of bleeding from the nose as compared with hemorrhage from other parts. Valsalva [4] observed in the dead-house that the vessels on the outer wall of the nose at the junction of the lateral cartilages are often very large, and J. P. Frank [5] states that he has noticed a varicose condition of the veins of the nasal mucous membrane in patients subject to epistaxis.

Diagnosis.—In all cases of epistaxis it is very important to make a careful examination of both nostrils and of the naso-pharynx, in order to ascertain whether there be any local condition, such as a tumor or an ulcer, which may cause the hemorrhage. It is scarcely necessary to point out that after falls or blows on the head epistaxis may be a symptom of fracture of the base of the skull through its anterior fossa.

Prognosis.—In giving an opinion as to the danger of epistaxis regard must first be had to the immediate risk from actual loss of blood. This, of course, will depend on the state of the pulse and the general condition of the patient. After this it must be determined whether the hemorrhage is accidental, *i.e.*, quasi-traumatic, or whether it is the result of some serious degenerative change in the walls of the arterioles, or whether it is due to obstruction in the pulmonary or hepatic circulation, or a combination of these conditions. It must not be forgotten that epistaxis, as Hughlings Jackson [6] has shown, may in some cases precede retinal hemorrhage and apoplexy. Accidental bleeding is seldom of serious import, for although among the older writers a considerable number of cases are to be found in which death resulted from nasal hemorrhage, the introduction of posterior plugging has to a great extent removed all danger. In elderly people, when epistaxis occurs spontaneously or from some very slight cause, it is generally a sign of degenerative changes in the vessels, and as such must be considered serious. In certain cases the bleeding appears to be beneficial, and its sudden stoppage is not unlikely to lead to mischievous results. Instances are on record in which mania,[7] epilepsy,[8] and asthma[9] are said to have ensued as a consequence of rash interference

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[1] Acta Eruditorum, Lipsiæ, 1688, p. 205.
[2] Observ. med. centuriæ tres, Francofurti, 1576, cent. i., obs. xc.
[3] Op. cit., cent. vi., obs. xiii.
[4] Quoted by Morgagni: Op. cit., ep. xiv., sec. 23.
[5] Op. cit., p. 144.
[6] London Hospital Clinical Lectures and Reports, 1866, vol. iii., p 251.
[7] Van Swieten: Comment. in Boerhavii Aphorismos, 1124.
[8] Hoffmann: De Epilepsiâ, obs. i.
[9] Raymond: Maladies qu'il est dangereux de guérir, p. 255.

with this natural depletion, and in cases of phthisis, renal disease, and cerebral mischief, the flow of blood from the nose sometimes appears to do good. So obviously beneficial, indeed, is epistaxis, in some cases, that, as already stated, its artificial production was a constant practice among the ancients for the relief of certain cerebral symptoms, and was recommended for this purpose by the enlightened Hoffmann.[1] In malarial fevers the old physicians considered that bleeding from the nose was an evidence of crisis, and was usually of happy augury for the patient, while in fevers of a low type it was looked upon as of dangerous import. In diphtheria, especially, it is a most grave symptom, being generally quickly followed by the development of false membrane in the nasal fossæ, if this extension has not preceded the epistaxis.

Treatment.—Sir Thomas Watson has well observed[2] that nasal hemorrhage is "sometimes a remedy; sometimes a warning; sometimes really in itself a disease." The question as to the advisability of arresting the hemorrhage must therefore first be considered. On this point some remarks by Peyer[3] may be found worthy of attention, even at the present day. He observes that plethoric youths, in whom bleeding from the nose is too quickly stopped, are prone to be attacked with pains about the head and in the ears, and with various catarrhal affections. Hence hemorrhage in these cases should not be interfered with, unless it is excessive, and produces faintness, pallor, and coldness. Again, where there is great venous obstruction, as in certain cases of cardiac and pulmonary disease, in cirrhosis of the liver, or in women where the hemorrhage takes the place of the monthly flow, the physician should be in no hurry to interfere, unless the bleeding lasts too long.

When it has been determined that it is desirable to arrest the hemorrhage, measures should be adopted in proportion to the activity of the flow. In the great majority of cases the bleeding soon ceases spontaneously, or if not, it can be stopped by some simple expedient. Position has obviously an important influence, and nothing can be worse than the common practice of holding the head over a basin. Jamain[4] has pointed out that not only is the flow increased by gravitation, but that the flexion of the head tends to compress the jugular veins, thereby hindering the return of the blood from the head, and favoring the hemorrhage. Hildanus[5] appears to have placed great faith in tightly bandaging the fore-arms to the arms and the legs to the thighs, and in very obstinate cases swathing the whole body in tight wrappings.[6] It is not improbable, however, that the success of this remarkable method was in some measure due to the fact that he used styptic powders at the same time. Keeping the patient on his back in the horizontal position is a simple procedure which I have often seen practised with excellent results. With the view of diminishing the flow of blood to the head, the very opposite plan, however, viz., that of maintaining the patient in an erect attitude, has been tried and found no less efficacious. A method has been recommendrd by Négrier[7] as being highly successful, which consists in raising the arm corresponding to the

[1] Med. Rationalis Systema. Opera omnia physico-medica, Genevæ, 1740, p. 200.
[2] Practice of Medicine, London, 1857, fourth edition, vol. i., p. 793.
[3] De morbis narium, Basileæ, 1766, p. 16.
[4] Gazette des Hôpitaux, 1855, No. 33. [5] Op. cit., cent. ii., obs. xv. and xvi.
[6] This method is still occasionally practised. Thus Blondeau (Union Médicale, December 8, 1877) claims to have checked bleeding from the nose by tying tapes tightly round the thigh when other measures had failed.
[7] Arch. Gén de Méd., 1842, p. 168.

bleeding side above the head, and compressing the nose with the fingers of the other hand ; but it is probable that *the pressure on the source of the hemorrhage*, like Hildanus' powder, is the real influence brought to bear. Négrier himself, however, considered that the extra strain put upon the heart to drive the blood to the end of the raised limb lessens the force of the current to the nose sufficiently to diminish the hemorrhage. The plan has at any rate the merit of requiring no apparatus whatever, so that it can be practised under all circumstances. The application of cold yields good results. It can be made either directly to the nose, or to other parts more or less remote, such as the brow, the nape of the neck, the feet or hands. The time-honored household remedy of putting a large key down the neck acts in this manner. A more certain plan consists in applying cold water or ice to the nose itself, or to the forehead. The patient may be directed to snuff up cold or (if it can be procured) iced water. Hildanus,[1] in a case which he considered desperate, took what he himself calls the extreme measure of plunging the whole body into a cold bath, with the result of instantly checking the hemorrhage. The use of *hot* water, which in recent years has been highly recommended for restraining other hemorrhages, has recently been advised for epistaxis by Keetley,[2] who says that the temperature of the water should be from 120° to 124° Fahr., and that it need not be syringed into the nasal cavity, but simply applied freely to the face.

The local application of styptics is often of great use. Powdered tannin, alum, or matico-leaf, may be snuffed up by the patient, or blown into the nostril with an insufflator. This treatment is often at once successful, particularly if the nostril is previously syringed out with a little cold water. Sprays of tannic acid (gr. x. ad ℥ j.) or perchloride of iron (♏ xx. ad ℥ j.) have also often proved very effectual in my hands.

Pressure may sometimes be made directly on the bleeding spot by introducing the finger into the nostril, the source of the hemorrhage being, in the majority of cases, on the outer wall, just inside the nose. Valsalva,[3] who, as has already been remarked, had observed on the dead subject that the veins on the outer wall of the nostril were often enlarged, used this ready method with striking success in a most obstinate case of nasal hemorrhage. Epistaxis may sometimes be controlled by pressure on the facial artery on the bleeding side. But undoubtedly the most effectual method of applying pressure to the bleeding surface is by plugging. The bleeding nostril should first be plugged anteriorly, and if this prove insufficient, median or posterior plugging must be resorted to.

Anterior plugging is best effected by pushing small strips of lint into the nose with a probe until the front part of the cavity is completely filled up. The lint may be used dry, or may be steeped in a solution of perchloride of iron, or in a mixture of the tannic and gallic acids.[4] Josiah Smyly[5] found the following method of plugging very successful. He prepared several strips of lint about a foot in length, and half an inch in breadth, and wrapping about two inches of one of these round a slender probe, he passed it quite through to the posterior orifice of the nares, then withdrawing the probe, he carefully pushed in as many

[1] Op. cit., cent. ii., obs. xvii.

[2] Practitioner, February, 1879.

[3] Quoted by Morgagni, op cit , ep xiv., sec. 23.

[4] The gargarisma acid. tann. et acid. gallici of the Throat Hospital Pharmacopœia (vol. i. Appendix, p. 422) is the best formula.

[5] In a letter quoted by Macnamara, loc. cit., pp. 53, 54.

strips of lint as were required to fill the nasal cavity. He also suggested using tampons of absorbent wick, or blotting-paper. Should the hemorrhage continue in spite of anterior plugging, recourse must be had to posterior plugging.

Median plugging, as has been shown, was recommended by Galen, and his plan of introducing a piece of sponge into the nose may often be used with advantage. A uterine sponge-tent will be found very serviceable for this purpose, but the handiest instrument is Cooper Rose's ingenious little air-plug, which has already been described (Fig. 69, p. 194). On the whole, however, this plan does not appear to be so effectual as the combination of posterior with anterior plugging.

Posterior plugging may be most readily performed with the aid of Bellocq's sound; the manner of using this instrument has been already described in the article on Nasal Instruments (p. 193 et seq.). Another apparatus invented for the purpose by Martin Saint-Ange,[1] and called by him a *rhinobyon*, may also be referred to (p. 194).

Unfortunately the various ingenious appliances which have been described are seldom at hand just when they are wanted, and, moreover, those made of skin or india-rubber are apt to be out of order. Hence, when an emergency arises, the surgeon is generally obliged to make use of some more simple, if less perfect, apparatus. The posterior nares can, however, be easily plugged by means of an elastic or a silver female catheter in the following manner: A small piece of thread is fastened through the eyes of the catheter, and to this a strong silk ligature or piece of whip-cord is attached. The instrument is passed along the floor of the nose, and when the string is seen in the pharynx, it is seized with the fingers or with forceps, and drawn out through the mouth. A pledget of lint is attached to the middle of the string projecting from the mouth, and the nasal end is then firmly pulled till the plug comes in contact with the posterior nares, and blocks up the orifice of the affected side. The string is subsequently retained in position by being fixed behind the ear with a strip of plaster. A small piece of string should be left hanging into the pharynx from the plug, by which it can be removed in due time. It is better to make the pledget of lint so hard as to be quite impervious, and to trust to mechanical pressure rather than to saturate the lint with a styptic solution; for unpleasant, and even serious consequences, may sometimes follow the use of a styptic plug, especially if perchloride of iron is employed. Even dry plugging is not altogether free from danger, Créquy[2] having reported a case in which extensive gangrene of the soft parts of the face came on almost immediately after this operation. Colles[3] saw tetanus result from plugging, and Habershon[4] states that he had met with a case in which pyæmia ensued. Gross[5] also mentions that he was acquainted with several cases in which death had resulted from blood-poisoning after plugging. These instances, however, appear to me only proofs of the danger of allowing the plug to remain too long *in situ*.

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[1] Lapeyroux: Méthode pour arrêter les Hémorrhagies nasales. Thèse de Paris, No. 314, 1836. A similar instrument was invented by Küchenmeister, and called by him a *rhineurynter* (Berlin. klin. Wochenschrift, May 29, 1871). See also Closset (ibid., June 19, 1871), and Bruns (ibid., July 31, 1871).

[2] Gazette des Hôpitaux, 1870, No. 56.

[3] Quoted by Macnamara, loc. cit., p. 58.

[4] The Lancet, February 27, 1875.

[5] System of Surgery, Philadelphia, 1882, sixth edition, vol. ii., p. 283.

Another possible danger is erysipelas, which, according to Monneret,[1] has been observed in several cases. The plug should not, as a rule, be left longer in the nose than forty-eight, or at the most seventy-two hours, and it should be removed very gently, so as not to disturb the clot, and bring on further hemorrhage. Very gentle irrigation through the healthy nostril with tepid water, to which common salt has been added in the proportion of a drachm of salt to a pint of water, will assist in loosening the plug. After its removal the nose should be gently washed out daily, or on alternate days, with some disinfectant or mild astringent solution, such as permanganate of potash (gr. ij. ad ℥ j.) or carbolic acid (gr. iv. ad ℥ j.).

Constitutional Treatment.—As the control of the bleeding is entirely in the power of the surgeon, medical measures are seldom needed. It is only in cases where the hemorrhage is frequent, but scarcely sufficiently serious to call for surgical treatment, that some internal styptic may be required. The best of these is ergot, which may be either given by the mouth or injected subcutaneously. Thirty drops of the tincture may be taken every two or three hours, or ten minims of a solution (one in five) of ergotine may be administered hypodermically every four hours. I have frequently found this method very useful. Laudanum is also an excellent astringent given in small doses of five to eight drops two or three times a day, but it is, of course, contra-indicated where the epistaxis originates in pulmonary obstruction. Other styptics, such as acetate of lead and gallic or sulphuric acid, can also be used for the purpose.

With a view of increasing the density of the blood, it has been recommended to administer sulphate of soda,[2] of which two drachms may be given every three hours, but I have never tried this remedy. Should the patient, when he comes under notice, be so exhausted that fatal syncope is to be feared, transfusion should, if possible, be carried out. Mosler[3] relates a case of hæmophilia in which not only was the epistaxis arrested by transfusion, but the tendency to repeated hemorrhage on slight occasions was altogether subdued. Both Sydenham and Hoffman recommended venesection for plethoric persons who bleed from the nose, and it appears to have been occasionally employed by J. P. Frank,[4] but this mode of treatment is only mentioned here to be absolutely condemned. In illustration of its utter futility, Fränkel relates an instance in which epistaxis actually occurred in a girl, during the operation of transfusion, for which she had offered herself as a subject.

In the plethoric cases a saline purgative taken two or three times a week in the morning, followed by a couple of doses of digitalis in the day, will be found serviceable. In the epistaxis of purpura, Macnamara asserts that turpentine is very efficacious, and he recommends that a wineglassful of spirits of turpentine in a tumbler of brandy or whiskey punch should be administered to the patient as rapidly as he can be got to swallow it.

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[1] See Martineau: Union Médicale, 1868, 3me série, t. vi., p. 330.

[2] Kunze: Compendium d. prakt. Med., fourth edition, p. 94.

[3] Op. cit. The views attributed to the various other authors from this point to the conclusion of this article will be found contained in their works, which have been previously cited in foot-notes.

[4] Op. cit., p. 140.

NON-MALIGNANT TUMORS OF THE NOSE.

Polypus of the Nose.

Latin Eq.—Polypi nasi.
French Eq.—Polypes du nez.
German Eq.—Nasenpolypen.
Italian Eq.—Polipi del naso.

Definition.—New formations, nearly always of myxomatous structure but sometimes containing a small amount of fibro-cellular tissue, usually pedunculated, round, oval, or pyriform in shape, of pale pinkish color, semi-transparent, varying in size from a currant to an acorn, but occasionally larger, giving rise to more or less obstruction of the nasal passages, with its associated symptoms.

History.—Nasal polypi have attracted attention from the earliest times, and they are referred to by nearly every writer on surgery from Hippocrates downward. The Father of Medicine,[1] indeed, must have had a large experience in connection with these growths, for though his classification is somewhat fanciful, his suggestions for treatment are of a highly practical nature, and show considerable fertility of resource. He directed that evulsion should be practised in the following manner: A piece of sponge of sufficient size to fill the nasal cavity having been selected, four strings, each one cubit in length, were attached to it, their free ends being tied together. A long flexible metal probe with an eye at one end was next passed through the nostril, and brought out at the mouth; the united ends of the strings were threaded through the eye of the probe, which was then drawn back through the nose. The strings were now seized by the operator, and by forcible traction the sponge was drawn through the nose, the mass of the polypus coming away with it. Whether the growths were removed by evulsion or with the cautery, Hippocrates afterward applied a dressing consisting of honey, to which there was occasionally added some strong caustic, and this was kept in contact with the parts by means of small leaden plates inserted into the nostrils. In the case of hard polypi, Hippocrates[2] directed that the nostril should be slit open, in order that the tumor might be thoroughly extirpated, and the roots afterward destroyed with the hot iron. Celsus[3] recommended that polypi should be destroyed with caustics or the hot iron, but he strongly disapproved of meddling with the harder tumors, which he considered malignant. Galen[4] described the disease as a preternatural growth, resembling in its nature the flesh of a polypus, and recommended the use of astringent local remedies in preference to the knife. Ætius,[5] on the other hand, advised that the cautery should be used for the destruction of polypi. Paul of Ægina,[6] who was an advocate of the knife, recommended the operator to dilate the patient's nostril with his left hand, while with the right he extirpated the polypus from the nasal passage by a circular sweep of a scalpel of peculiar shape. The mass was then to be withdrawn from the nose with the other end of the instrument, which probably ended in a hook. Abulcasis[7] directed that the growth should be drawn out of the nose as far as possible with forceps, and then cut off with the knife. The stump was afterward to be scraped, so as to destroy the roots of the polypus. Guy de Chauliac[8] recommended that polypi should be removed by evulsion. To William of Salicet[9] belongs the credit of intro-

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[1] De Morbis, lib. ii., Littré's ed., Paris, 1851, vol. ii., p. 51.
[2] Ibid., p. 53.
[3] De Medicinâ, lib. vi., cap. viii.
[4] De comp. pharm. sec. locos, lib. iii., cap. iii.
[5] Tetrabibl., ii., serm. ii., cap. lxxxix.
[6] Lib. vi., cap. xxv.
[7] Lib. ii., cap. xxiv. (Chirurgie d'Abulcasis, traduite par le Dr. Lucien Leclerc), Paris, 1861, p. 93 et seq.
[8] Le Guydon [Guy] en Francoys, par Maistre Jean Camappe, Lyon, 1538, fol. 198.
[9] Chirurgia Guilielmi de Saliceto, in Ars Chirurgica Guidonis Cauliaci, Venetiis, 1546, p. 308.

ducing the plan of strangulation of nasal polypi by tying a ligature tightly round the pedicle. He advised that the channel of the nose should be widened, if necessary, by means of sponge tents, or serpentary root, and that the tumor should be tied tightly as near its root as possible, with a thread of doubled silk. In cases where this was impracticable, the growth was to be extirpated by evulsion with forceps. In any case, the stump was to be destroyed by means of corrosive applications or the actual cautery. Arantius,[1] being dissatisfied with the treatment by the knife, also invented a kind of blunt forceps, with which he tore away the polypus. To obtain a better view of the parts, he always operated in a darkened room, a round hole in the shutter allowing the sunlight to fall into the patient's nose; or, if the day was dull, artificial illumination was procured from a lighted candle placed behind a phial of glass containing clear water. Fabricius ab Aquapendente[2] claimed to have invented an instrument for the removal of polypi of such excellence that "patients came to him from every side, with the firmest confidence of being cured." His invention appears to have been a pair of forceps, the cutting blades and shanks of which were deeply hollowed, so that when closed the instrument formed a kind of canula, through which a hot wire could be passed, or powder blown. To this surgeon has often been assigned the merit of having first proposed the evulsion of polypi with forceps; but this is certainly erroneous, for it has just been shown that William of Salicet[3] had recommended this method long before. It may be added, indeed, that Fabricius himself made no claim to be the inventor of the *method*, but only of a particular instrument which was designed to *cut* polypi without the dangers attending the use of the *spatha*, or ancient scalpel. He may therefore, perhaps, be termed the inventor of "cutting forceps." In 1628 Glandorp[4] published a treatise on polypus remarkable for its erudition, and, moreover, containing a very accurate account of the affection. Boerhaave[5] afterward propounded a theory that nasal polypi are formed by a prolongation of the lining membrane of the pituitary sinuses. His idea was that the secretion in one of the cells becoming from some cause or other too thick, does not escape properly from the cavity, which thus becames filled up, till its lining membrane is protruded into the nasal fossa, where it is suspended as a membranous sac, filled with fluid or semi-fluid contents. Heister[6] explained the growth of nasal polypi by obstruction of one or more of the glands of the pituitary membrane leading to the formation of a tumor. Morgagni[7] may be mentioned as quoting with approval Valsalva's practice of removing the lamella of bone on which the polypus grows, with the view of preventing recurrence. Levret,[8] who was chiefly known as a very successful gynæcologist, seems to have been led by his experience in dealing with uterine and vaginal tumors, to turn his attention to nasal polypi, and he invented several ingenious instruments for applying and tightening ligatures. Pallucci[9] soon afterward attempted to improve upon Levret's method, and, if his statements may be believed, he was one of the most successful operators in this branch of surgery that ever existed. Early in the present century Robertson[10] published an account, together with a drawing, of an instrument for snaring nasal polypi. The irony of the fate of inventions is indeed shown in this little instrument, for Robertson's nasal snare is acknowledged by Wilde to be the instrument on which he modelled his aural snare, while later on, Hilton, unaware of the original purpose of the appliance, modified Wilde's instrument so that it might be used for the nose. In modern times short treatises on nasal polypi have been published by Gruner,[11] Dzondi,[12] W. Colles,[13] Mathieu,[14] and Thudichum,[15] besides innumerable communications to the medical journals of

[1] De tumoribus præter naturam, Appendix to his treatise, De humano fœtu, Venitiis, 1587, p. 170 et seq.

[2] Operationes Chirurgicæ, cap. xxiv., in Opera Chirurgica, Lugduni Batavorum, 1723, p. 438 et seq.

[3] Op. cit. See also Arantius, op. cit.

[4] Tractatus de polypo. Bremen, 1628, cap. vii.

[5] Prælectiones ad Institut, ad § 498.

[6] General System of Surgery, English Transl., London, 1743, pt. ii., p. 437 et seq.

[7] De sedibus et causis morb., ed. sec., Patavii, 1765, epist. xiv., sec. 19–20.

[8] Obs. sur la Cure radicale de plusieurs Polypes, Paris, 1771, third edition, p. 214 et seq.

[9] Ratio facilis atque tuta narium curandi polypos. Viennæ, 1763.

[10] Edinburgh Med. and Surg. Journ., 1805, vol. i., p. 410.

[11] De polypis in cavo narium obviis. Lipsiæ, 1825.

[12] Ergo polypi narium nequaquam extrahendi. Halæ, 1830.

[13] Nasal Polypi, Dub. Quart. Journ. of Med. Sci., November, 1848, p. 373 et seq

[14] Sur les Polypes muqueux des arrière-narines, Thèse de Paris, 1875.

[15] On Polypus in the Nose, etc., London, 1869, third edition, 1877.

Europe and America. The subject has also been treated of more or less fully in every general text-book on surgery, the contributions of Durham[1] and Spillman[2] being especially worthy of mention. One of the most recent works which has reference to the malady is that of Zuckerkandl,[3] whose treatise is of great value in relation to the morbid anatomy of the complaint.

Etiology.—The causes of nasal polypus are quite unknown. That mere chronic inflammation is not sufficient to produce it is proved by the fact that while persistent catarrh is more often met with in children than in adults, mucous polypi are very rare under the age of sixteen. In adults the affection is exceeding common, being found, according to Zuckerkandl[4] (if looked for), in every eighth or ninth autopsy. From the annexed Table (A) it will be seen that the decennium from twenty to thirty furnishes the greatest number of cases—42 per cent. Men are more liable to the affection than women, the proportion in my 200 cases being 123 men to 77 women. The youngest patient I have met was a girl aged sixteen, the youngest boy having been seventeen. Examples of much younger patients than these will be found in medical literature, but I believe that in nearly all of them the growths were malignant or fibrous. Mason[5] has, however, reported a case of a boy, whose age was only twelve, from whom he removed several large polypi. The greatest age at which a polypus commenced in my series was sixty-nine, but I have seen two other cases in which the disease originated at sixty-five and sixty-eight respectively.

TABLE A.—*Showing the Age and Sex of Two Hundred Patients with Nasal Polypus. The Table indicates as nearly as possible the Age at which the Growths commenced.*

Age.	Male.	Female.
16 to 20	9	7
20 to 30	51	34
30 to 40	33	13
40 to 50	18	13
50 to 60	9	10
60 to 70	3	..
	123	77

The older writers, who had somewhat vague ideas in the matter of etiology, attributed polypi to such influences as heredity, struma, syphilis, miasma, and suppressed menstruation, but these antiquated notions will not stand the rigorous analysis of the present day. Occasionally polypi seem to arise from mechanical irritation, such as may be produced by foreign bodies, but the case of Van Meekren,[6] in which the nucleus of a polypus was formed by a splinter of wood, is open to suspicion. Gerdy[7] has

[1] Holmes' System of Surgery, vol. iv.
[2] Dict. Encyclop. des Sci. Med., art. Nez.
[3] Normale u. pathol. Anatomie der Nasenhöhle, Wien, 1882, p. 64 et seq.
[4] Op. cit., p. 70.
[5] Med. Soc. Proceed., London, 1872–4, vol. i., p. 156 et seq. The date of Mr. Mason's paper is March 2, 1874. In this report the age of the patient was stated to have been twelve, while according to the catalogue of the Royal College of Surgeons, to whose museum the growths were presented, the age was ten.
[6] Quoted by Morgani, loc. cit.
[7] Des Polypes et de leur Traitement, Paris, 1833, pp. 4, 5.

reported a case in which a large polypus followed a fracture of the bony septum.

Symptoms.—In the earliest stage the patient suffers from increased secretion, stuffiness of the nose, and sometimes slight pain in the frontal region, together with a partial and variable occlusion of one or both nostrils. Polypi being generally pedunculated, a sensation like that caused by a foreign body moving backward and forward, or up and down, within the nasal cavity is sometimes experienced about this period. For the same reason these growths occasionally have a valve-like action, opposing the passage of air outward or inward as the case may be. They sometimes, indeed, give rise to a peculiar flapping sound, described by Dupuytren as the "bruit de drapeau." It need scarcely be pointed out, however, that in the presence of so many objective signs, this symptom is of no importance. When both the nasal passages are blocked up, the patient is of course compelled to breathe entirely through the mouth, and the usual phenomena of nasal obstruction supervene, the voice undergoing the characteristic modification, and the sense of smell being impaired or altogether lost. It is very seldom that these growths cause any bulging of the nasal parietes, and only in quite exceptional cases that the tear-duct being pressed upon epiphora results. Owing to the fact that mucous polypi possess a hygrometric property, all the symptoms are generally aggravated in damp weather. The discharge from the nose is usually watery in character, and seldom offensive, while epistaxis only quite occasionally occurs.

Polypi, when large, numerous, and growing from the anterior part of the cavity, can usually be seen by simply looking into the nose with the aid of a strong light, the tip of the organ being at the same time tilted upward and backward, but the introduction of a speculum will greatly assist the view. These growths most frequently *appear* to originate from the middle turbinated body and the parts immediately above it (see Table B), but the recent researches of Zuckerkandl (see Pathology, p. 254) show that the real origin of nasal polypi is often far deeper than clinical evidence indicates.

TABLE B.—*Showing the Apparent Situation of Two Hundred and Fifty-nine Polypi observed by the Author in Two Hundred Patients, the Growths having been Bilateral Fifty-nine Times.*

Middle turbinated body	104
Neighborhood of superior turbinated body and superior meatus	77
Middle turbinated body and middle meatus	34
Middle meatus	24
Inferior turbinated body	9
Whole of outer wall of nose (except inferior meatus)	11
	259

Only in very rare cases is the septum the site of the affection. Bryant,[1] Leriche,[2] Clinton Wagner,[3] and Hartmann,[4] each report one example, and

[1] Manual of the Practice of Surgery, third edition, London, 1879, vol. ii., p. 7.
[2] Gaz. des Hôpitaux, 1874, No. 73.
[3] Arch. of Clin. Surg., New York, January, 1877.
[4] Deutsch. med. Wochenschrift, 1879, Nos. 28–30.

Zuckerkandl [1] has met with three specimens. These are the only authentic instances that I am acquainted with. Polypi, however, springing from the turbinated bodies sometimes press so firmly against the septum that it is extremely difficult to pass the finest probe between that partition and the tumor, and under such circumstances a mistake as to the origin of the polypus is likely to be made. By means of posterior rhinoscopy I have seen several cases of small symmetrical growths on the septum, but these were always either of adenoid structure, or consisted of simple hypertrophy of the mucous membrane.

Mucous polypi generally remain within the nasal cavity, but when very large they may extend forward and even project from the nostril. Sometimes they grow toward the pharynx, and can then be easily discovered by posterior rhinoscopy. Occasionally a polypus in its growth becomes attached at several different points to the contiguous walls of the nares, but this result of friction and pressure is more likely to be seen in the case of fibrous polypi than in those of myxomatous structure. In very rare instances a mucous polypus may by pressure destroy the periosteum, and one case has been reported by Colles in which the bones of the nose were separated by such a growth.[2]

Mucous polypi are generally multiple, and according to my experience (see Table B) occur on both sides in nearly thirty per cent. Globular in shape at first, they most frequently hang loosely from the nasal wall, being suspended by a narrow pedicle. It is thus that gravitation acting on their semi-fluid contents soon determines their characteristic tear-shaped outline. They do not, however, always retain this form, for, as Gruner remarks, the larger the size to which they attain the more they recede from their pyriform shape, as they are easily moulded by the unyielding structures which after a time confine them on every side.

The views which have just been expressed are, however, opposed to the recent anatomical observations of Zuckerkandl,[3] who maintains that there are two kinds of polypus, viz., those of oval form with narrow pedicle, and those of round shape with broad base, the former growing from sharp edges, the latter from flat surfaces. Zuckerkandl maintains that the globular tumors are never converted into the oval, but that each kind possesses its peculiar shape from the time of its first appearance. Polypi vary in size from a tare to a chestnut, but when requiring treatment are most frequently between a currant and a grape in size. I have met with one exceptional case, however, in which the growth, when stretched out, measured five inches in length, and was seven-eighths of an inch in diameter at its base (Fig. 78). I removed the polypus from a gentleman aged twenty-two, in the presence of Dr. Snell, of Mile End. No recurrence had taken place nine years later. A more remarkable example still has been reported by Stoerk,[4] in which a polypus springing from within the posterior nares reached down to the larynx. There are often one or two polypi about the size of a small grape or currant, and a great number of others which are scarcely visible. Their color is generally dull yellow, but occasionally they are grayish-white or pink. Their surface is smooth

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[1] Zur path. u. phys. Anatomie der Nasenhöhle u. ihre pneumat. Anhänge. Wien. med. Jahrb., 1879. See also Anatomie der Nasenhöhle, p. 84. It appears doubtful from the description whether all Zuckerkandl's cases were examples of true polypi.

[2] Dub. Quart. Journ. Med. Sci., No. 12, November, 1848, p. 374.

[3] Op. cit., p. 78 et seq.

[4] Krankheiten des Kehlkopfes, Stuttgart, 1880, p. 105.

and shining, and when touched lightly with a probe they dimple through their elasticity, returning at once to their former shape. When a strong light is directed on the polypus, it generally has a somewhat translucent appearance. Mucous polypi are devoid of sensibility, the pain which is felt on their forcible removal being due to their connection with the mucous membrane.

FIG. 78.—Polypus removed by the Author.

The ordinary symptoms attending the presence of a polypus in the nose having been described, it is necessary to add a few remarks on a much more serious class of troubles to which attention has been called in recent years. Soon after Voltolini[1] had recorded an instance in which asthma resulted from the presence of a polypus in the nasal passages, similar cases were reported by Hänisch,[2] Porter,[3] Daly,[4] Todd,[5] Spencer,[6] Mulhall,[7] Joal,[8] and Jaquin,[9] and the reflex causation of asthma from nasal polypi has been discussed by Schäffer,[10] Fränkel,[11] and Bresgen.[12] The whole subject of the reflex effects of nasal obstruction, and especially of polypi, has been recently studied with great ability by Hack,[13] who considers that nightmare, cough, hemicrania, brow-ague, certain vasomotor phenomena shown by quasi-erysipelatous symptoms (in which there is temporary limited redness of the cheeks), attacks of giddiness, epilepsy, rhinorrhœa, and hay fever often owe their origin to polypus, or tumefaction of the nasal mucous membrane. Hack gives many illustrative cases in which the various complaints referred to were cured by surgical operations within the nose, and it may be added that his etiological views have already received independent support from other observers. Löwe[14] has

[1] Die Anwendung d. Galvanokaustik, Wien, 1872, p. 246, 4 Aufl.
[2] Berlin. klin. Wochenschrift, 1874, No. 40.
[3] New York Med. Record, October 11, 1879; also Arch. of Laryngology, 1882, vol. iii., No. 2.
[4] Arch. of Laryngology, vol. ii.
[5] Trans. Missouri State Med. Association, 1881.
[6] Quoted by Todd, ibid.
[7] St. Louis Med. Surg. Journ., February, 1882.
[8] Gaz. des Hôpitaux, 1882, p. 442 et seq.
[9] Ibid., 1882, p. 507.
[10] Deutsche med. Wochenschrift, 1879, Nos. 32 and 33.
[11] Berlin. klin. Wochenschrift, 1881, Nos. 16 and 17.
[12] Volkmann's klin. Vorträge, 1882, No. 216.
[13] Wien. med. Wochenschrift, 1882, Nos. 49, 50, and 51; and 1883, No. 4 et seq.
[14] Allgemeine med. Central Zeitung, 1882, No. 76.

reported a case in which epileptic fits, which had before been of almost daily occurrence, suddenly ceased when the nasal passage was made clear. The obstruction had been produced by a polypus in the left nostril, accompanied by hypertrophy of the mucous membrane covering the lower turbinated body, and adenoid vegetations about the posterior nares. When these sources of irritation had been removed the fits only came on under the influence of some extraordinary mental disturbance.

In connection with this last case, I may state that I have lately treated (with Dr. Hughlings Jackson and Dr. Sillifant, of Barnsbury) a gentleman, aged fifty-five, who had suffered for some months from attacks of extreme restlessness, together with such severe dyspnœa that he was unable to lie down at night. He also had violent paroxysms of facial spasm, and on one or two occasions epileptiform seizures, during which he was unconscious for twenty minutes or half an hour. There was a mass of polypi in the upper part of the nasal passages on both sides. These growths having been almost completely removed the paroxysms of dyspnœa entirely ceased, and the other nervous symptoms gradually disappeared. Elsberg[1] has also met with cases of chorea, epilepsy, supra-orbital headache, and hemicrania, due to reflex irritation within the nose. Seiler[2] has reported two cases, and refers to two others in which he believes that thickening of the anterior part of the inferior turbinated bodies was the cause of a troublesome cough. The cases described are not very conclusive, but in both of them treatment of the nose relieved the laryngeal symptom. John Mackenzie[3] has found cough so frequently a reflex symptom of nasal disease that he has ceased to regard it as a curiosity. He is of opinion that the posterior portion of the middle and inferior turbinated bodies with the corresponding part of the septum are the special seats of reflex irritability. Hack,[4] on the other hand, concludes from his own observations, that reflex phenomena, such as cough and sneezing, may be produced by irritation of any part of the lining membrane of the nose, but that such manifestations do not take place *until the anterior part of the lower turbinated body has first become turgid.*

The following examples of asthma dependent on growths in the nares occurred in my own practice :

One of these cases was that of a lady, aged sixty-three, who consulted me in March, 1874. She had suffered for three years from severe attacks of asthma, which came on nearly every night. Various remedies had been used with partial success, but the asthma was entirely cured by the removal of two large polypi—one from each middle turbinated body.

In the second case the patient was a gentleman, aged forty-seven, whom I first saw in July, 1876. During the previous five years he had suffered occasionally from asthma, the paroxysms, as in the last case, always occurring at night. The removal of a quantity of small growths from the neighborhood of the superior turbinated body on the right side entirely relieved the patient of his asthmatic attacks, which, however, returned, after an interval of four months. The recurrence of the dyspnœa was found to be coincident with a fresh development of polypi, and on their removal the symptoms again passed off.

In a third patient, recently sent to me by Dr. Hughes of Llanberis, very severe attacks of asthma appeared to have been caused by the presence of polypi in the nose ; violent paroxysms were also produced by the insufflation of tannic acid.

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[1] Philadelphia Med. News, May 26, 1883, p. 604.
[2] Arch. of Laryngology, 1882, vol. iii., p. 240 et seq.
[3] Amer. Journ. Med. Sci., July, 1883, p. 106 et seq.
[4] Loc. cit., p. 36.

Daly [1] has recently maintained that the disposition to hay fever must be sought for in chronic hypertrophy of the mucous membrane of the nose, and this theory has been adopted by Roe,[2] of Albany. My own experience, however, does not confirm the view.

While fully admitting that many reflex phenomena may arise from disease within the nose, I must caution the younger specialists that the various complaints referred to as resulting from nasal disease are much more frequently due to other conditions, and that every other possible cause must be eliminated before the nose is incriminated.

Diagnosis.—Although in most cases it is easy to diagnose nasal polypi, yet mistakes do occasionally occur. The gelatinous softness, elasticity, mobility, and pale semi-transparent appearance of these tumors are, however, very characteristic features, and serve to distinguish them from most other swellings. Fibrous, sarcomatous, and cancerous growths are usually much harder, bleed easily on being touched, cause considerable pain, and often produce great disfigurement. Cartilaginous or osseous tumors are so hard that their real nature is at once evident. Deviation of the septum has occasionally been mistaken for a polypus ; but when this condition exists there is an irregular projection into one nasal passage and a corresponding depression in the other, showing the character of the affection. Chronic abscess of the septum has frequently been mistaken for polypus, but it differs almost diametrically from that complaint. For while a polypus hangs almost invariably from the outer wall of the nasal cavity by a pedicle, an abscess is situated on the septum and has a broad origin. Moreover, in cases of abscess there is, in the vast majority of instances, a similar swelling in the other nostril, the bases of the tumors accurately corresponding with each other on the two sides of the septum. Blood tumors present the same general characters as abscesses, except that they are of dark purple color. In both cases there is usually a history of more or less recent injury to the nose. In any doubtful instance, however, puncture of one of the tumors will solve the question as to its nature.

The condition most likely to be mistaken for polypus is thickening of the mucous membrane covering the inferior turbinated bones. This mistake is frequently made by practitioners, owing to the fact that in systematic surgical works the diagnosis between these conditions has not hitherto been pointed out. Polypi, however, though often bilateral, are seldom so symmetrical as is the thickening of the turbinated bodies, and while the color of the former is pale yellow or pink, that of the hypertrophied turbinated bodies is either bright, or dark, red. Again, though the thickened mucous membrane pits a little under the probe, the entire body does not move as in the case of a polypus. It must not be forgotten, however, that polypus and hypertrophy often coexist. A foreign body might possibly be mistaken for a polypus, but the inflammation and fetid discharge from the nose which accompany it will make the practitioner suspect something more than a mucous growth. Among rare conditions, which need only be referred to as curiosities, may be mentioned mucous distention of the ethmoidal cells and hernia of the brain. The museum of St. Thomas' Hospital contains two examples of the former affection, in which the appearance during life must have closely resembled mucous polypi.[3] As Spencer Watson [4] observes with regard to these specimens,

[1] Arch. of Laryngology, 1882, vol. iii., p. 157 et seq.
[2] New York Med. Journ., May 12, 1883, p. 509 et seq.
[3] Museum Catalogue, sec. i., Nos. 14 and 15.
[4] Diseases of the Nose, London, 1876, p. 73.

the hard wall of the projecting body and the escape of the pent-up mucus on puncture would determine their nature. A curious case was reported by Cruveilhier,[1] in which a hernia of the dura mater and brain through the cribriform plate of the ethmoid bone, exactly resembling a polypus, was discovered at a post-mortem examination. Such a tumor, however, would move rhythmically with the respiration and pulsate with the systole of the heart; moreover, in its development cerebral symptoms would be almost sure to occur.

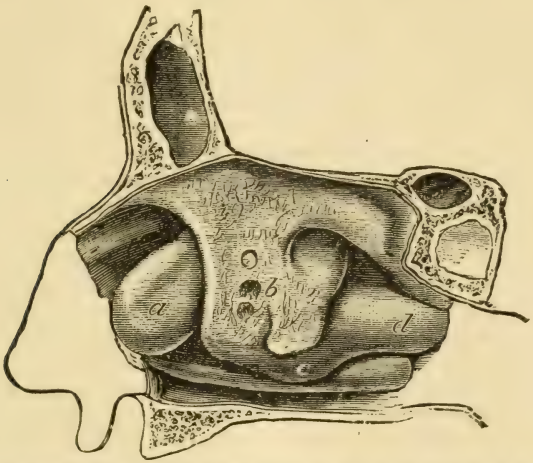

FIG. 79.—From Specimen No. 2201a in the Museum of the Royal College of Surgeons. *a*, polypus hanging from the middle meatus; *b*, apron-like flap hanging from the vault of the nose and upper turbinated body, and partly covering *d*, the middle turbinated body, which is greatly thickened; *c*, portion of middle, projecting over the lower turbinated body. Near *b* are three small abrasions, possibly caused by the pressure of the inner wall.

Pathology.—The external investment of these polypi is usually composed of ciliated epithelium, and beneath this outer layer there are generally a few dilated capillaries but no nerves. The bulk of the growth is made up of embryonic connective tissue, consisting of a hyaline gelatinous material through which more resisting cellular trabeculæ pass in various directions. The gelatinous substance is very rich in mucin, and contains in the early state round and oval cells, which at a later period become elongated, fusiform or stellate, and for the most part nucleated and granular. According to Cornil and Ranvier,[2] the latter kind of cell is most common. The consistency of the growth depends on the greater or less degree in which the connective stroma or the mucous substance predominates in its structure. Here and there small cavities full of colorless stringy fluid may be met with. Some observers regard such growths as true cysts, but Follin and Duplay [3] consider that the absence of any distinct wall shows that these formations are not really of cystic character. Zuckerkandl,[4] however, maintains that he has occasionally found cysts in the neighborhood of nasal polypi. They are, he says, of white color, and generally the size of a bean, but he once saw a cyst as large as a hazel-nut growing from the anterior part of the lower turbinated body, and containing a honey-

[1] Anatom. Pathol. du Corps Humain, Paris, 1835–42, t. ii., livraison xxvi., pp. 5, 6.
[2] Manuel d'Histol. Path., Paris, 1869, p. 145.
[3] Traité Elém. de Path. externe, Paris, 1877, t. iii., p. 812.
[4] Op. cit., p. 100.

like fluid. Sometimes nasal polypi contain glandulæ, but the growths themselves never appear to be of glandular origin. Hypertrophy of the mucous membrane is very frequently associated with the presence of polypi, while, on the other hand, these growths often give rise to atrophy of the soft structures.

The exact site of origin of nasal polypi is a matter of perhaps even more importance than their minute structure, and valuable information on this subject may be obtained from Zuckerkandl,[1] who has recently published the post-mortem reports of thirty-nine cases of polypus and polypoid thickening of the mucous membrane of the nose. The great value of these observations depends on their having been made after the gradual removal of the various bony parts which interfered with a view of the deep origin of the growths. In a few of Zuckerkandl's cases, the disease was nothing more than simple hypertrophy, one or two others were of doubtful character, one was a papilloma, in two instances the growth was really in the naso-pharynx, while in three, polypoid excrescences grew from the septum. In several instances, however, the polypi were multiple, so that the exact seat of attachment of 42[2] distinct growths could be determined; 14 grew from the edges of the *hiatus semilunaris*, 3 from the edges of the *hiatus* and the *infundibulum*, 2 entirely from within the *infundibulum*, 1 from the *ostium frontale*, 1 from the *ostium sphenoidale*, 1 from the *ostium ethmoidale*, 2 from the *antrum*, 10 from the *middle meatus*, 3 from the *upper meatus*, 4 from the *middle*, and 1 from the *upper turbinated* body.

Prognosis.—Mucous polypi cause great inconvenience and annoyance, but are very seldom attended with any serious risk, certain extremely rare reflex phenomena already described being perhaps the most alarming features. True polypus so rarely causes any disfigurement that this matter may be dismissed from consideration. Even after the growth has apparently been completely removed, however, there is a great probability of the patient being again troubled with the complaint. This is partly owing to the fact that the real origin often cannot be reached, and partly to the circumstance that very small polypi no doubt often exist which are not visible at the time when the larger growths are removed. When relieved, however, from pressure, the minute excrescences at once commence to grow.

Spontaneous expulsion[3] of a polypus sometimes takes place, and I have seen several cases where this has occurred. In my experience, however, it has only happened when several polypi were crowded together, and has, therefore, not affected the prospects of cure. Spontaneous *absorption* is said to have occurred in one case;[4] but as the polypus (?) gave rise to most intense headache, while it grew with extreme rapidity and finally sloughed away, it can scarcely be classed with the disease now under consideration.

Treatment.—Medical remedies have been used from a very early period with the view of drying up nasal polypi, a method of cure which the gelatinous nature of the growth naturally suggested. Galen advised the use of alum and pomegranate juice. At a later period chloride of antimony and sulphuric acid were much employed with the same object, and in modern times various astringents and caustics have been recommended.

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[1] Op cit., p. 64 et seq.

[2] Op. cit., pp. 64 to 84. In reality the actual number of separate growths was more than this, for in some cases where a single site is given there were "several" polypi.

[3] Michel: Op. cit., p. 55.

[4] Maddock: Lancet, 1836–37, vol. ii., pp. 590, 591.

In 1821 Primus, of Babenhausen,[1] reported two successful cases from the use of the saffronized tincture of opium of the Prussian Pharmacopœia. According to that surgeon, the polypus, if painted with this solution several times a day for about a week or ten days, under favorable circumstances shrivels up and becomes detached. Bryant[2] strongly recommends the application of finely powdered tannin by means of his nasal insufflator (Fig. 37, p. 177), but though in the case of nervous patients who have objected to an operation I have tried this remedy, I cannot say I have ever found it do any good. Nitrate of silver was successfully used by Nélaton.[3]

Reeder,[4] of Illinois, is stated to have employed strong injections of perchloride of iron with good effect in two cases. Erichsen[5] mentions that he has seen one case in which injections of chloride of zinc caused the separation by sloughing of a polypus so large that it blocked up the nostril completely and descended into the pharynx. Frédéricq[6] claims to have obtained excellent results from the application of a saturated watery solution of bichromate of potash to the polypus. He states that it produces some inflammation, which is followed by absorption of the growth. The application may have to be repeated once or twice, but Frédéricq affirms that he has cured several cases in this manner within five or six days, that he has seldom seen any recurrence, and that he has never known any ill effect follow the use of the bichromate. Donaldson,[7] of Baltimore, has found great benefit from chromic acid. The mucous membrane is painted with a solution of lead, and a paste of chromic acid is applied to the polypus by burying a glass rod smeared with the agent in the substance of the tumor. The mass dries up, and can then be easily removed with forceps at the same sitting.

The general experience, however, is that astringents offer so slender a chance of doing any good, that it is hardly worth while to make a trial of them. By the application of strong caustics or escharotics, no doubt nearly all nasal myxomata may be destroyed; but the cure is very tedious and painful, and, moreover, it is difficult to limit the action of the agent to the tumor. Electrolytic treatment would no doubt sometimes succeed in destroying these growths, but its operation would probably be extremely tedious.

Surgical Measures.—There are three principal methods of removing or destroying nasal polypi, viz., evulsion, abscission, and electric cautery.

Evulsion with forceps is the oldest and still the most generally practised method, and it must be admitted that it is a very rapid way of removing polypi, but the ease with which it can usually be carried out led practitioners in former times to suppose that the proceeding was equally applicable to all intra-nasal growths, wherever situated, and whatever the nature of their attachments. Acting on such premises, surgeons of the last century increased the size and leverage of their forceps, and adapted them by suitable curves for introduction, either by the nostril or through the pharynx, as if no more consideration were necessary than to seize every nasal tumor

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[1] Hartenkeil's Medico-Chir. Zeitung, Salzburg, 1821, p. 56.

[2] Lancet, February, 1867, p. 235.

[3] Pathologie Chirurgicale, Paris, 1874, 2me ed., t. iii., p. 748.

[4] Quoted by Gross: System of Surgery, Philadelphia, 1882, sixth edition, vol. ii., p. 290.

[5] Science and Art of Surgery, sixth edition, vol. ii., p. 320.

[6] Mémoire présentée à la Société de Médecine de Gand, 1862. Quoted by Spillmann, Dict. Encyclop., t. xiii., p. 88.

[7] Philadelphia Medical News, May 26, 1883, p. 597.

with tenacity and wrench it away with violence. Tearing away of the septum, and even great injury to the ethmoid and nasal bones, not unfrequently resulted from such vigorous surgery, and it is not surprising that this mode of treatment, after a time, met with opposition.

But although the practice has since then been placed on a rational and scientific basis, attempts have been recently made to revive the prejudice against it which was once so well founded. While usually practised by general surgeons, and still almost universally recommended in our standard text-books on surgery,[1] some leading specialists of the day condemn it in the strongest terms. Voltolini[2] says: "Of late years, the forceps has superseded all other instruments, and as the result of its employment, severe mutilations are frequently seen in the nose. Many distinguished surgeons admit that evulsion is one of the most brutal and disagreeable operations. . . . The forceps, blindly introduced, tears away or injures everything that comes in the way, whether it is healthy or diseased, soft or hard (turbinated bones and nasal septum)." He adds that, "In operations with forceps, the greatest force has to be used in some cases; in fact one has to pull, as it were, 'for life,' in order to get away the polypus." Michel[3] states that, "as the result of operations by others with forceps, he has seen luxation of the cartilaginous septum, fracture of the bones, removal of portions of the turbinated bones, circumstances which increase the sufferings of the patients, and render the operation quite horrible." Zaufal,[4] in recommending the snare, says that he hopes "to render utterly impossible in the future the obsolete, barbarous forceps-operation so unworthy of modern surgery."

More recently, Lémeré[5] has ransacked French medical literature in order to bring together all the cases he could find in which bad results have followed evulsion. He divides them into immediate and remote. Among the immediate dangers, however, he only mentions hemorrhage, and, as an illustration, adduces one case in which Gosselin had to plug the nares, and another case (from Gerdy) in which the hemorrhage had to be stopped in the same way. In the latter case the patient died, but as the tumor was clearly shown to be a fibrona it does not bear on the question of evulsion of mucous polypi. Among the remote dangers he adduces the following: (1) Obliteration of the nasal duct, (2) injury to the antrum or frontal sinuses, (3) injury to veins, (4) injury to the bones of the nose and skull, and (5) rapid exuberant recurrence. Under the first head, only one case from Péan is given, which was ultimately cured. In illustration of the injury to the frontal sinuses and antrum, he adduces a case (also from Péan) in which a man suffered for twelve years from a deep-seated tumor on the cheek, which the *patient stated* commenced after the evulsion of a polypus. An exploratory puncture gave issue to a syrupy liquid, amber in color, and containing cholesterine crystals. As an example of injury to the frontal sinus, Lémeré reports two cases; one (from Broca), in which an abscess, which formed in the frontal sinus a few weeks after evulsion of a polypus from the nose, was cured in three months; and another case (from Demarquay) in which the patient, aged seventy-four, was attacked with abscess of the frontal sinus after a polypus had been

[1] Erichsen, Gant, Bryant, Fergusson, Gross, Hueter, Lücke, Albert, and Duplay.
[2] Die Anwendung der Galvanokaustik, p. 243.
[3] Die Krankheiten der Nasenhöhle, Berlin, 1876, p. 57.
[4] Die Allgemeine Verwendbarkeit der kalten Drahtschlinge, 1878. See preface.
[5] Sur les Accidents consécutifs à l'Arrachement des Polypes des Fosses nasales. Paris, 1877.

torn away. The bone was trephined and the patient cured. As an instance of injury to the veins, he brings forward the last case again, recurrence having taken place the following year. Evulsion again gave rise to erysipelas, and six months afterward the operation was again performed with similar results; three months later evulsion was repeated, and the stump treated with nitrate of silver. This was followed by intense pain on the right side of the head, and violent inflammation of the pituitary membrane. Twelve days afterward, the right lower eyelid became greatly depressed, the right eye fixed, with its pupil dilated, and insensible to light. Death occurred a fortnight after the operation. At the post-mortem examination, congestion of the meninges was found at the base of the brain on the right side. The body of the sphenoid was friable, and pus oozed through the *sella turcica*. The cavernous sinus was bathed in pus, and there was purulent infiltration of the right pituitary membrane. The sphenoidal, ethmoidal, and maxillary sinuses were full of pus. The case does not exactly seem to have been one of venous infection, but rather an extension of inflammation from the nose to the sinuses and the brain. It is clear that the repeated operations ought not to have been undertaken, as the patient was an old man, exceedingly prone to erysipelas; but as he was a medical practitioner, he probably insisted on measures which were clearly unsuitable, and the case has no bearing on the general merits of evulsion. In illustration of injury to the bones of the skull, Lémeré mentions a case (from Tillaux) in which a patient applied for relief on account of a constant flow of liquid from the nose, which, on examination by Robin and Méhu, was found to be pure cerebro-spinal fluid. Evulsion had been previously practised on this patient on two occasions, and Tillaux considered that, in one of the operations, the cribriform plate of the ethmoid bone must have been broken through by the forceps. The only example which Lémeré gives of exuberant recurrence was clearly a case of cancer.

From the above cases, collected from a treatise professedly written to exemplify the dangers of evulsion, it will be seen how difficult it is to bring forward any tangible evidence against the operation. Albert,[1] in his recent work, has defended this method against the attacks of specialists. The following are some of his remarks on the subject: "In late years, this method (the operation by forceps) has been condemned as brutal, painful, and inefficient. There is no doubt that it can be performed brutally by rough or clumsy hands; but the conservative surgeon does not grope blindly in the nasal cavity; on the contrary, he places the patient in a proper position, makes use of a nasal speculum, and carefully selecting forceps suitable as regards the size and situation of the polypus, he seizes it by the pedicle, and extracts it by gentle rotatory movements." He adds, that "the hostility to the old universally-practised method (evulsion by forceps) is merely the outcome of the elaborate methods used by the specialist with an object which it is easy to understand." Specialists might perhaps retort that the hostility of some surgeons to new and improved methods of cure, which they have themselves failed to master, has a motive which it is equally easy to understand. But such amenities are better avoided in scientific discussions.

It is curious that the principal objection urged by Voltolini, Michel, and others, against the practice of evulsion with forceps, viz., that a portion of one of the turbinated bones is often torn away, is considered a recom-

[1] Lehrbuch der Chirurgie, Wien u. Leipzig, 1881, Bd. i., p. 305.

mendation by the advocates of the forceps. It has already been shown (see History) that in the seventeenth century, Valsalva,[1] for the purpose of preventing the recurrence of the growth, introduced the practice of removing, together with the polypus, the lamella of bone from which it springs; and in our own time, the two leading conservative surgeons, Fergusson[2] and Pirogoff[3] have advocated the same treatment. I may add that I have myself frequently removed portions of the turbinated bones without seeing any evil result follow; and it appears to me extremely doubtful whether any bad effect could be produced by the *partial* removal of *one* of these bones.

It is no doubt perfectly true that air breathed through the nose reaches the lungs at a higher temperature than when it is inspired through the mouth, and that this is due, in some measure, to the peculiar vascular structure of the turbinated bodies. The interesting experiment of Gréhant,[4] by which the temperature of air expired by the lungs previously inspired through the nose, was compared with that expired after previous oral inspiration, first proved this to be the case. The following are the details of the experiments: A small thermometer was enclosed in a glass tube, each end of which was stopped with a cork perforated so as to allow free passage to a current of air. This apparatus was then placed inside a second tube, the space between the two being filled up with cotton-wool. The outer tube having next been introduced into the mouth, with the bulb of the thermometer at a distance of from one to two centimetres from the lips, air was inspired through the nose, the aperture in the outer tube being closed meanwhile with the tongue; finally expiration was performed through the apparatus containing the thermometer. Under these circumstances, the temperature of the atmosphere being 71.6 F., that of the air expired through the tube was found to be 95.7°. On the other hand, when air was drawn in through the mouth (the tube being closed with the tongue, as before), the temperature of the air expired through the tube was only 93.5°. The temperature of the expired air in these experiments was found to vary, being lower at the commencement of the act of expiration than at its conclusion; the temperature given by Gréhant, therefore, was a mean of that observed at three periods, viz., the commencement, the middle, and the conclusion of expiration. This feature, as well as some other points, not appearing quite satisfactory, I thought it desirable to repeat the experiment in a slightly modified form, and in the following investigations my assistant, Dr. George F. Hawley (U.S.A.), afforded me material help. Instead of expiration being made directly on the thermometer, I employed an india-rubber bag of the capacity of one gallon. Into the further end of the bag a thermometer was fitted, while to its proximal extremity a piece of tubing, which served as a mouthpiece, was attached. The temperature of the expired air, when previously inspired through the nose, was now compared with the expired air after oral inspiration. With the thermometer set at 70 F., the expired air after nasal inspiration, as the result of a large number of experiments, showed an average temperature of 75.1°, while the average temperature after oral inspiration was only 73.6°, or, in other words, nasal inspiration raised the temperature a degree and a half higher than oral inspiration.

Such experiments are, however, always open to objection, as they do not show the actual difference in the air after inspiration through the nose and mouth respectively, but only the difference in the expired air after the two different modes of inspiration. It was thought desirable, therefore, to make more direct experiments. A thermometer was accordingly supported in such a way that it could be worn in the mouth with the bulb in the pharynx on one side between the uvula and the pharyngeal wall. The support of the instrument consisted of a wooden bar, with a hole in its centre, just big enough to admit the introduction of the thermometer, and retain it in position; it was held between the teeth, like a horse's bit, in such a way that the subject's lips did not touch the thermometer. When the instrument was placed in the pharynx, and allowed

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[1] Morgagni: De sedibus et causis morb., Patavii, 1765, ep. xiv., sec. 19.

[2] Although there is no mention of it in his published writings, I often heard this great surgeon remark, that one could never feel sure of the complete removal of a polypus, unless a portion of the bone was taken away with it.

[3] Klinische Chirurgie, 3tes Heft., Leipzig, 1854, p. 73.

[4] Recherches physiques sur la Respiration de l'Homme, Thése de Paris, No. 161, 1864, p. 30 et seq.

to attain to a temperature of 90° F., it was found as the result of a large number of experiments that gentle[1] nasal inspiration reduced the temperature only half a degree, while gentle oral inspiration lowered the temperature a degree and a half, showing a superiority of one degree in the heating power of the nasal channels as compared with the mouth.

It is possible that if these experiments had been carried out in an atmosphere at a lower temperature the influence of nasal inspiration would have been more marked, but, after all, the experiments only show that when the air reaches the lungs after passing through the comparatively long and narrow passages of the nose, it arrives in the pharynx at a higher temperature than when it passes directly through the mouth.

The real use of nasal inspiration, however, consists probably more in the protection it affords against the entrance of minute foreign bodies rather than in its thermic effects on the inspired air. The advantage of inspiring through the nose, in fact, lies in the exclusion of the irritating matters floating in the air, which, if they elude the vibrissæ, are likely to become deposited in the nasal passages, and are thus prevented entering the lungs.[2] The bad effect of oral respiration indeed is not seen in the chest but in the pharynx, where the mucous membrane becomes dried by exposure to the air, and irritated by particles of dust floating in the atmosphere.

The thermic influence of nasal inspiration is probably due to the passage of the air through a narrow canal lined by a thin mucous membrane abundantly supplied with vessels, rather than to the special structure of the turbinated bodies. The peculiar erectile structure of these parts, moreover, is only seen to perfection in the *inferior* turbinated body, and it is not this, but the *middle* body which sometimes requires partial removal. But if, taking into consideration the peculiar histological character of the turbinated bodies, their physiological importance be conceded, it does not follow that the ablation of *a portion of one* of the bones would be attended with any unfavorable results. I go further, however, and do not hesitate to assert that there are some polypi, which, from their anatomical situation, cannot be extirpated unless a portion of a turbinated bone is also taken away. A mere glance at the annexed sketches (Figs. 80 and 81) renders it evident that a polypus springing from any of the localities marked × could not be taken away except by previous or simultaneous removal of a lamella of bone, especially when the position of the nares in

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[1] Forcible inspiration produced such variable results that the experiments were unsatisfactory.

[2] Catlin (The Breath of Life, London, 1861, p. 39), the great apostle of nose-breathing, has carried his enthusiasm somewhat too far, and has confused cause and effect in a most amusing way. Thus, in the case of those people who cannot close the mouth, he asserts that "the derangement and deformity of the teeth" proves the "long practice of the baneful habit" (mouth-breathing), and he adds "that the mouth of the hyena and donkey are agreeable, and even handsome, by the side of such people." The expression of persons who cannot close the mouth is not always prepossessing, but it seems a little hard that they should be compared unfavorably with the donkey and even the hyena. It is scarcely necessary to point out that the deformity of the teeth referred to does not *result* from mouth-breathing, but that in certain cases the direction of the teeth prevents the patient closing the mouth, and that he is thus naturally inclined to use the mouth in breathing. The irregularity of the teeth commences at the second dentition, through the abnormal development and projection forward of the intermaxillary bone. It is most frequently a hereditary peculiarity, and is in no possible way caused by breathing through the mouth.

Catlin also states that among the American Indians deafness, dumbness, spinal curvature, and death from teething and diseases of the respiratory passages are almost unknown; and he attributes this exemption to the habit of breathing through the nose, so universally practised by them!

relation to those localities is taken into consideration. This view is, moreover, amply confirmed by the recent observations of Zuckerkandl (p. 254) as regards the origin of polypi. The well-known disposition to recurrence of these growths, which has already been pointed out (see Prognosis) is one of the great causes of difficulty in dealing with them. Now there cannot be the least doubt that in some cases the ablation of the lamella of bone from which the polypus springs is the most certain method of preventing any fresh development of the growth, while in others its origin can only be reached by first taking away a portion of bone. In conclusion, it may be confidently asserted that if any slight trouble should arise in consequence of the removal of a piece of bone, this will at any rate be far less than the annoyance caused by a mass blocking up the nose, and perhaps requiring repeated operations for its eradication.

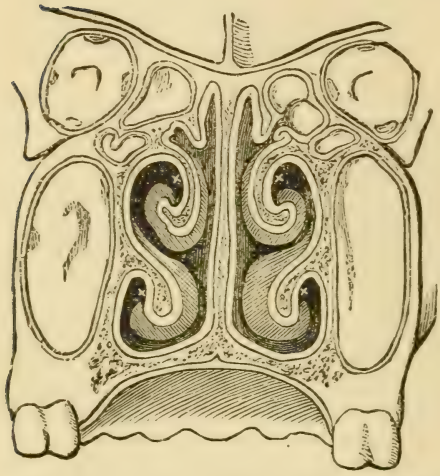

FIG. 80.—Transverse Vertical Section through the Nasal Fossæ at a Point behind the first Molar Teeth (after Hirschfeld). The × at four different points shows the supposed origin of polypi.

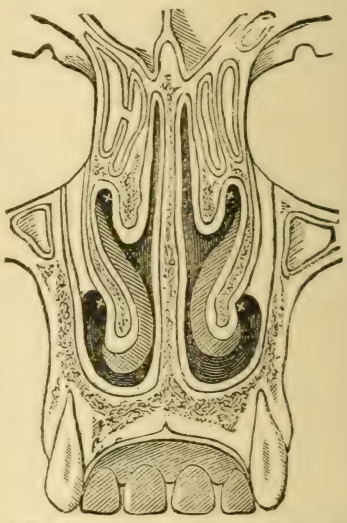

FIG. 81.—Transverse Vertical Section of the Nasal Fossæ in the Plane of the Bicuspid Teeth (after Hirschfeld). The × at four different points indicates the supposed point of origin of polypi.

The subject of the removal of a portion of one of the turbinated bones has been treated here because this ablation is often *accidentally* effected in evulsion, but it must not be supposed that it is an essential feature in the operation. It is, indeed, only in quite a small proportion of cases that it occurs. When it is thought desirable to remove a portion of bone it is certainly better to cut it away (see Abscission) than to practise evulsion, as by the latter operation the quantity of bone which comes away cannot be controlled.

The great advantage of evulsion is not only the *facility* with which the treatment can be carried out, but the *rapidity with which relief* can always be obtained. More growths can generally be taken away at a single sitting than can be got rid of either with the snare or by electric cautery. Although, as a rule, celerity is not a chief consideration in treatment, yet cases every now and then occur in which time is a most important element, and this point should certainly be thought of in judging of the relative

merits of surgical methods, when it does not involve any risk to life, health, or the integrity of any important function. The operation of evulsion holds an intermediate position, neither deserving the extreme abuse it has received from specialists, nor the high encomiums of general surgeons. In my opinion it is altogether an inferior method to removal by electric cautery, and I feel convinced that no practitioner who has had a large experience in operating with suitably constructed electrical apparatus *would ever allow evulsion to be performed on himself.* Nevertheless, as the number of surgeons who have the opportunity of acquiring skill in using electro-cautery will always be limited, it is necessary to fall back on less perfect modes of treatment; and where a more refined method cannot be employed evulsion may be resorted to with a good prospect of favorable results. At the same time I think it right to state that though I formerly practised evulsion extensively I now seldom employ it, having found that electric cautery gives less pain to the patient, and causes no hemorrhage. Abscission with cutting forceps is also, to my mind, a preferable operation.

In practising evulsion, the interior of the nose is to be first thoroughly exposed (see the Application of Anterior Rhinoscopy, p. 169), the growth is then seized, the blades of the forceps firmly compressed, and lastly, the handle of the instrument moved up and down, and slightly twisted to one side. The value of this process was first pointed out by Dzondi, who recommended that the polypus should be drawn forward with one pair of light forceps, while with another pair its root was bruised as close as possible to its attachment. It is seldom, however, that there is room for using two pairs of forceps at the same time in so confined a space. An ingenious modification of the common forceps (Fig. 54, p. 187) has been made by George Stoker, by which the tumor can be really twisted off instead of being torn away. Where the mass is large, and situated far back, it is best to use the common polypus-forceps (Fig. 49, p. 184). The blades of this instrument should, after careful determination of the site of the growth, be introduced into the nose, when, by passing the index finger of the left hand round the uvula into the posterior nares, the polypus can easily be seized. In these cases the administration of nitrous oxide gas greatly facilitates the operation.

Evulsion by means of a sponge was first recommended by Hippocrates, and the mode of carrying it out has already been described (see History). In modern times the practice has been revived by McRuer,[1] who "succeeded in at least ten cases in bringing away all the adventitious growths." Voltolini[2] has also quite lately reported a case successfully treated by this method.

When the growth is situated far back it can sometimes be more easily reached through the pharynx than through the anterior orifice of the nose. In a case in which Morand[3] had failed to get away the mass of a polypus with forceps, he was able to remove it through the pharynx, loosening it from its attachment, partly by direct pressure and partly with his finger-nail. This proceeding was practised with equal success in another case by Sabatier.[4] Gross[5] also contrived to remove a large polypus situated far

[1] Holmes' System of Surgery, first edition, 1862, p. 216.
[2] Monatsschrift für Ohrenheilkunde, 1882, No. 1.
[3] Opuscules de Chirurgie. Paris, 1768–72.
[4] Medecine Opératoire, Paris, 1824, t. iii., p. 283.
[5] System of Surgery, sixth edition, Philadelphia, 1882, vol ii., p. 291.

back in the nasal fossa by "breaking it off with the index finger introduced into the mouth, and carried round the palate."

Abscission.—This method of treatment may be carried out either with the snare, écraseur, or cutting-forceps. Since Hilton (see History) recommended the snare it has been widely used, and Durham [1] observes that in his experience this method has proved "more easy and effectual, and less painful, and less likely to prove mischievous than other methods commonly adopted." Except when instruments provided with Zaufal's arrangement (p. 188) are employed, the following is the best way of applying the snare: The noose having been introduced vertically should be turned into a horizontal position, and made to encircle the polypus, when it is pushed upward as far as it will go, in order to seize the pedicle as near as possible to its root. If the growth be very far back and hang into the naso-pharynx, the snare may be put round it, by passing a string through the nose by means of Bellocq's sound. The nasal extremity of the string is then attached to the noose, which is drawn up to the tumor by traction on the buccal end of the string. The loop is next adjusted with the help of the index finger, and tightened in the ordinary way. For the slow strangulation of growths which show a tendency to bleed, Jarvis' instrument, or one of the modifications of it, is particularly useful. My nasal écraseur (Fig. 59, p. 190) will also be found serviceable in these cases.

Gant has adopted grape-scissors for the removal of polypus from the nose, and has successfully used the instrument in several cases (Fig. 50, p. 185). The most convenient way of carrying out abscission will, however, I believe, be found in the employment of my punch-forceps (Fig. 51, p. 185), which is so slender that it can be easily passed along the nasal passages without obstructing the view of the operator, yet so strong that it readily cuts through the pedicle of any polypus. With this instrument the slipping off of the wire, which, in spite of every precaution, must occur very frequently with the snare, is avoided. Surgeons who, not having the necessary apparatus, cannot employ the more perfect method of electro-cautery, will find that with the punch-forceps they can generally quickly clear the nasal passages. My clinical experience of the superiority of forceps over snare and écraseur has been recently confirmed by the very important anatomical researches of Zuckerkandl,[2] who, after a careful study of the deep origin of nasal polypi, points out that in many instances "forceps can accomplish more than the snare."

In some cases, with the view of preventing recurrence, it is desirable, as already remarked (p. 258), to remove a small portion of one of the spongy bones. This can be most easily done with my punch-forceps. The operation can be carried out more satisfactorily if an anæsthetic is given, as in removing a part of the middle turbinated bone painful pressure is sometimes brought to bear on the upper part of the nostril. The following cases illustrate the advantage of taking away a piece of a turbinated bone:

Case 1.—Mr. E. F., aged thirty-seven, consulted me in May, 1875, on account of polypus in the right nasal passage. The symptoms commenced in January, 1871, and he then was operated on twice with forceps by an eminent surgeon. The growth returned, and Mr. F. was again treated in the same way by the same operator, in the following August. The nose remained clear till July, 1872, when polypi again formed, and Mr. F. placed himself under another surgeon, who in two months (twenty-five

[1] Holmes' System of Surgery, second edition, 1870, vol. iv., p. 300.
[2] Op. cit., p. 81.

visits) removed a number of polypi with a snare. The patient believed himself cured, but remained well only seven months. He then went back to the last operator, who performed repeated operations with the snare through the year 1873, and indeed up to May, 1874, when the nose became quite clear. In December the polypus again showed itself, and the next month the patient applied to me. On making a careful examination I perceived a large polypus growing from the anterior half of the middle turbinated bone. In view of the repeated recurrence, I determined to remove a portion of bone. This was easily done. (The appearance of the growth with a portion of bone after its removal is shown in the annexed cut, Fig. 82.) The patient came to me (1880) on account of follicular disease of the throat, when I learned that there had been no recurrence of the nasal polypus, nor any unpleasant effects from the removal of the bone.

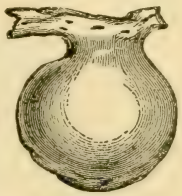

FIG. 82. — Polypus with Portion of Bone removed with Nasal Bone-forceps.

FIG. 83. — Polypus with Osseous Lamina removed with the Nasal Bone-forceps.

CASE 2.—Mrs. L., aged fifty-nine, consulted me in July, 1878, on account of polypus in the right side of nose. Since 1871 she had been treated by seven different practitioners. Of these five had used forceps, one a snare, and one electric cautery. The latter treatment had been carried out in 1876 and the beginning of 1877, and the polypus had been burnt sixty-four times. Mrs. L. said that this treatment was not painful, but it caused "a peculiar sensation which went to her brain." I removed a bit of the middle portion of the turbinated bone with a small polypus attached (Fig. 83). I saw this patient again in June, 1881. The nose had remained free from any recurrence of the disease, and no inconvenience of any kind had been experienced since the operation.

Electric Cautery.—This method was first introduced by Middeldorpf,[1] and subsequently improved by Voltolini,[2] Thudichum,[3] and Michel,[4] by all of whom it is strongly recommended. I consider it by far the best method of treatment which exists.[5] Patients who have had the opportunity of comparing this method with evulsion invariably prefer electro-cautery. It is much less painful, and the *pain ceases the moment the current is turned off;* it has also the great advantage of not causing any hemorrhage. The only drawback to the method is that it is tedious, and requires many sittings. I employ a flat spatula-like electrode, and endeavor to push it backward over the surface of the mucous membrane, from which the polypus grows. The cure can be most quickly accomplished by using the cautery and the punch-forceps on alternate days, the latter being only employed for taking away the dead tissue. Some practitioners prefer using the electro-cautery in form of a loop, but the trouble of applying the snare, in my opinion, complicates the operation. Sneezing is often caused by the cautery, but in my experience never comes on till after the withdrawal of the electrode.

FIBROUS POLYPI OF THE NOSE.

Though fibrous polypus of the naso-pharynx is not unfrequently met with, this form of tumor extremely seldom originates in the nose itself, the only case, as far as I am aware, in which such a growth has been

[1] Die Galvanokaustik Breslau, 1854.
[2] Die Galvanokaustik. Breslau, 1867.
[3] Polypus in the Nose, first edition. London, 1869. See also third edition, 1877.
[4] Krankheiten der Nasenhöhle, Berlin, 1876, p. 56 et seq.
[5] Those who are not in the habit of working with electro-cautery will, of course, find it a troublesome method, and it can really be only carried out successfully by those who constantly employ it.

actually proved to exist being one of my own, hereafter related. There are, however, two other instances in which there is every reason to believe that the tumors were fibromata. One of these was reported by Gerdy[1] as having occurred in a boy aged thirteen. The left nostril had been occupied by a growth for eighteen months, and endeavors had been made to remove it with the ligature and by evulsion, but the tumor was so hard that the blades of the forceps were turned. The patient finally died of hemorrhage, brought on by an attempt to cut through the base of the polypus with a bistoury. After death the growth was found to be attached to the posterior part of the vault of the left nasal fossa; its substance was very firm and elastic, and could not be torn with the fingers, and on section it was seen to be of purely fibrous structure. In the other case, which is related by Lichtenberg,[2] the polypus was found to spring from the upper turbinated body; there were also some polypoid excrescences, apparently independent of the larger growth, attached to the under surface of the cribriform plate of the ethmoid. The microscope does not appear to have been used in either Gerdy's or Lichtenberg's cases.

The *treatment* consists in removal of the tumor, if possible *per vias naturales*. According to its situation, it should be attacked, either anteriorly or posteriorly, by evulsion, abscission, or electric cautery. Lichtenberg, however, in order to obtain access to the growth on which he operated, was obliged to perform temporary resection of the bridge of the nose. The following are the details of my own case:

Mrs. M., aged thirty-five, consulted me, by the advice of Mr. Crowdy, of St. John's, Newfoundland, on February 12, 1877. She had suffered for two years from obstruction of the right side of the nose. On making an examination the pharynx

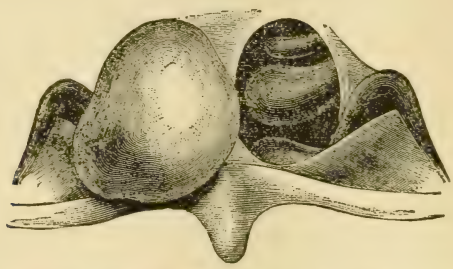

Fig. 84.—Fibrous Polypus of the Nose. View of the growth as seen by posterior rhinoscopy.

was found to be very granular, and there was general inflammation of its posterior wall. The anterior nares were healthy. Owing to the extreme nervousness of the patient, it was impossible to make a satisfactory post-rhinoscopic examination, and it was not until she had been under my care some weeks that I succeeded in obtaining a view. I then discovered a large red, smooth, irregularly oval growth, blocking up and projecting beyond the right choana (Fig. 84). On examination with the sound the polypus was found to be hard, but slightly elastic, and from its mobility appeared to be pedunculated. On the first attempt I succeeded in seizing it and tearing it away with short, curved, blunt forceps. After removal the stump could be felt on the roof of the nasal fossa, well within the cavity; the growth was the size of a pigeon's egg, and on section was hard, dense, and pale. Microscopically it was seen to be composed of closely interlaced whitish fibres, with a few minute cells lying among them.

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[1] Des Polypes et de leur Traitement, Paris, 1833, p. 19.
[2] Lancet, 1872, vol. ii., p. 773 et seq.

Papillomata of the Nose.

Small warty growths are sometimes found in the nose, and according to Hopmann,[1] they are much more common than is generally supposed. In a series of 100 cases of growths in the nasal cavities this observer met with no fewer than 14 examples of papilloma.[2] These were of two pathological varieties, viz., epithelial papilloma, or benign cauliflower excrescence, and soft papilloma; the latter being subdivided, according to the predominance of gland-structure, vessels, areolar tissue, or proliferating cells, into adenoma, angioma, fibro-sarcoma, and fibro-sarcoma papillare. The growths generally varied in size, roughly speaking, from a pea to a hazel-nut, but Hopmann removed [3] one which measured 4 ctm. in length and from one to one and a half in breadth and thickness. In several instances the tumors were multiple, as many as ten or twelve being present in one case. They were invariably attached to the lower turbinated body, generally springing from its convex surface, or its lower border, but sometimes from its concave portion. The symptoms caused by the presence of these tumors were frequent cough and expectoration, dry catarrh, and in some cases retching of such severity as to excite suspicion of gastric disease. There were also the usual signs of obstruction of the nasal passage, and in two cases there was some bleeding.

Had it not been that Hopmann shows himself [4] to be perfectly familiar with the appearance and symptoms of general thickening of the inferior turbinated body, a comparatively common complaint, which has already been described (p 221 et seq.), it might have been supposed that he had mistaken this condition for true papillary neoplasia. It would seem, however, to result from this observer's investigations that many growths which closely resemble mucous polypi are really of papillary structure; this, at least, is the only way in which the wide discrepancy between his observations and those of other pathologists can be explained. For my own part I must confess that, although I remove polypi from the nose almost daily, I now hardly ever make any miscroscopical examination of the growths, and this may account for the fact that I have met with only five undoubted examples of intra-nasal papilloma. In all of them the tumor was situated on the mucous membrane over the lower and anterior part of the septum, or on the inner plate of the alar cartilage where it joins its fellow in the middle line close to the tip of the nose. In no instance was the excrescence larger than a split pea, and in four of the cases there were at the same time mucous polypi in the nasal fossa. The specimen in the Museum of the Royal College of Surgeons, described in the catalogue (No. 2,201 C) as a polypus, has more the appearance (see Fig. 77, p. 223) of a papilloma. Zuckerkandl [5] met with only one example of true papilloma, and this was situated on the middle of the lower turbinated body; but three other cases which he describes as "polypoid excrescences" bear a close similarity both to the specimen in the Hunterian Museum just referred to, and likewise to some of Hopmann's cases.

The application of strong nitric acid or electric cautery rapidly destroys

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[1] Virchow's Archiv, Bd. xciii., 1883.

[2] From a more recent paper by Hopmann (Wien. med. Presse, 1883) it appears that Schäffer, of Bremen, has found twenty cases of papilloma among one hundred and eighty-two nasal polypi.

[3] Loc. cit., p. 225.

[4] Loc. cit., p. 247.

[5] Op. cit., p. 70.

these growths, but they can also be removed with the cutting-forceps or snare, and Féré [1] has reported a case in which he effected a cure with a ligature.

Erectile Tumor of the Pituitary Membrane.

An extraordinary case of this kind (probably analogous in its pathological characters to the vascular variety of soft papilloma described by Hopmann) was reported by Verneuil,[2] in 1875. The patient, a Roumanian, aged fifty-two, had been subject to frequent and abundant bleeding from the nose since boyhood. During the ten years previous to his coming under notice, the hemorrhage had become so formidable as to have reduced the patient to an extremely anæmic condition. Various internal remedies were tried, without avail, and the inside of the nose was cauterized, with the view of healing a supposed ulcer within the cavity. When the eschar came away, however, the bleeding broke out again as severely as before. At this time he consulted Verneuil, who, after a careful examination, found, on the left side of the septum, a round, dark-red, sessile swelling of the size of a cherry-stone, pulsating synchronously with the heart. Several other small erectile patches were found in various parts of the patient's body—the right temple, the soft palate, etc. No hemorrhage, however, had ever been known to occur from any of those spots. At a second examination, made in the presence of M. Gosselin, Verneuil failed to discover the tumor in the left nasal fossa, but found a swelling exactly similar in character on the right side. Radical measures having been decided on, Verneuil laid open both sides of the nose, and destroyed the greater part of the septum with the actual cautery. The parts were then douched with cold water for some time, and the wound was closed on the left side, the right being allowed to remain open, and plugged with lint steeped in perchloride of iron. Wet compresses were kept constantly applied to the brow and nose. In spite of this there was pretty sharp bleeding on several occasions, and Verneuil was obliged once more to apply the actual cautery to the interior of the right nasal fossa. There was no further hemorrhage, and in a short time the patient was able to return to Roumania. Two years after the operation the patient continued well, but four years later he appears to have died in a state of extreme cachexia; Verneuil states, however, that he was unable to obtain any details on this point.

Enchondromata of the Nose.

Cartilaginous tumors of the nose are very rare. Examples have, however, been reported by Erichsen,[3] Bryant [4] (two cases), Ure,[5] Durham,[6] Richet,[7] Heurtaux,[8] and Verneuil,[9] and I have myself met with one example of the affection. The disease belongs essentially to the period of life when the growth of the body is most active, all the patients whose

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[1] Bull. de la Soc. Anat., 1880, 4e série, t. v., p. 587.
[2] Annales des Maladies de l'Oreille, etc., t. i., p. 169 et seq.
[3] Lancet, 1864, vol. ii., p. 152. [4] Ibid., 1867, vol. ii., p. 225.
[5] Holmes' System of Surgery, London, 1870, second edition, vol. iv., p. 319.
[6] Ibid. [7] Casabianca: Des Affections de la Cloison, Paris, 1876, p. 59.
[8] Bull. de la Soc. de Chir., Nov. 7, 1877.
[9] Quoted by Spillmann: Dict. Encyclop. des Sciences Méd., t. xiii., p. 184.

cases have been quoted above having been under the age of eighteen.[1] As regards sex, the disease shows a slight preference for the male sex.

The most marked *symptoms* are obstruction of the nasal passages, and deformity in advanced cases amounting to "frog-face" (see Fibrous Polypi of the Naso-Pharynx). The ordinary phenomena of catarrh, such as abundant discharge and sneezing, have sometimes been observed. In the patient I treated the discharge was of such an offensive character, that the disease had been mistaken for ozæna. The growth may vary in size from a hazel-nut to a man's fist, or may be even larger. The tumor, when small, closely resembles a fibrous polypus, but it is never distinctly pedunculated, and usually springs from the cartilaginous part of the septum, although in rare cases it may originate from the outer wall or roof of the nose.

The *prognosis* is favorable if the disease is detected at an early period, as the growth shows no disposition to return when once removed, but if it has attained large dimensions before treatment is commenced, it may happen that a cure cannot be effected without making an external incision, and thus causing a more or less unsightly scar.

The *diagnosis* is difficult when the growth has attained a large size, as it may be mistaken for fibrous polypus, a malignant neoplasm, an exostosis, or an osteoma. The extreme rarity with which fibroma commences in the nose almost permits its exclusion from consideration. Malignant tumors have not the dense consistence of enchondromata, bleed more readily and grow more rapidly, while bony formations are very hard, and cannot be penetrated by a needle, like cartilage.

Surgical *treatment* is alone of any service, and the snare is the best instrument that can be used, its employment with electric cautery being especially indicated. In my own case, however, which is detailed below, I had no difficulty in cutting through the mass with the cold wire.

CASE OF ENCHONDROMA REMOVED WITH THE SNARE.

Miss E., aged thirteen, was brought to me, in September, 1874, on account of an offensive discharge from the nose, from which she had suffered for two years. She had been treated for "polypus" and "ozæna" by different surgeons, but without deriving any permanent benefit. There was a marked prominence of the right side of the nose, midway between the inner canthus of the eye and the upper border of the alar cartilage. On examining the nose with a speculum, a round, nodulated tumor was seen in the right nasal fossa The growth, which was firmly attached, was of a purple red color and slightly ulcerated at its outer part. It so completely occupied the fossa, that it was only after repeated examinations that its origin from the upper and back part of the cartilaginous septum could be made out.

A needle passed into the tumor without much difficulty, and caused but little hemorrhage, and it was thought that the growth was a fibroma.

Several attempts at removal with the forceps proved unavailing; but I ultimately succeeded in passing a wire round the tumor and cutting it through. Even after the growth was separated, however, it was impossible, owing to its size, to draw it through the nostril; and it was only by dividing it into two portions with the snare, that it could be got out. After its removal, its base was seen to be about half an inch in diameter. On microscopical examination of the tumor, its central portion was seen to consist almost entirely of hyaline cartilage, but toward its circumference there were numerous bundles of white fibres, and a small amount of yellow elastic tissue. It looked as if it had originally been covered with a fibrous envelope, which had been subsequently destroyed in places by erosion. The patient made a rapid recovery; but

[1] In Heurtaux's case the age is stated as twenty-two, but the disease had been in existence for five years.

slight thickening of the septum remained, and indeed had not disappeared nine months after the operation.

Osteomata of the Nose.

Latin Eq.—Tumores ossei nasi.
French Eq.—Tumeurs osseuses du nez.
German Eq.—Knochengeschwülste der Nase.
Italian Eq.—Tumori ossei del naso.

Definition.—Bony tumors, generally of exceedingly dense but occasionally cancellous structure, varying in size from a bean to a hen's egg, and sometimes even larger, having no connection with the osseous framework of the nose, causing obstruction of the nasal passages, and if allowed to attain a great size eroding and frequently perforating the parietes of the nasal cavities.

History.—The mention of "osseous" tumors of the nose is not uncommon in the older writers, but the actual literature of the subject is altogether modern, and, as might be presumed from the rarity of the affection, is also very scanty. Some doubtful cases were collected by Bordenave [1] in the latter half of last century, and a few scattered examples may be found in the medical journals of the earlier part of the present century. Follin,[2] however, appears to have been one of the first to call attention to such growths as a substantive disease, quite distinct from exostosis. Cases have since been reported by Hilton,[3] Pamard,[4] and Legouest,[5] and the complaint has been made the subject of special research by Ollivier,[6] Gaubert,[7] and Rendu.[8] A good chapter on nasal osteomata may be found in Follin and Duplay's[9] large work, and quite recently Spillman [10] has discussed these singular growths with great care.

Etiology.—The causes of osteomata are quite unknown. The only point about which there is any certainty is that the affection belongs to the period of adolescence. Most of the patients who have suffered have been about twenty years of age, though sometimes the disease has escaped observation till a later period. As far as can be ascertained both sexes are equally liable to the complaint.

Symptoms.—The most characteristic symptom in the early stage of the disease is an itching sensation in and about the affected part, which is sometimes so intolerable that the patient is compelled to relieve himself by constantly scratching the inside of his nose. As soon as the tumor attains any considerable volume it gives rise to the usual symptoms of obstruction. This is often impairment of the sense of smell, and epistaxis generally becomes frequent and severe as the growth develops. The patient usually complains of severe neuralgic pain, caused, no doubt, by the pressure of the bony mass on neighboring nerve-filaments. The growth,

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[1] Memoires de l'Académie Royale de Médicine. Paris, 1774.
[2] Des Tumeurs osseuses sans connexion avec les os, Bull. de la Soc. de Biologie. Paris, 1850–51.
[3] Guy's Hosp. Reports, series i., vol. i., p. 495.
[4] Exostose éburnée de la Fosse nasale droite, Bull. de la Soc. de Chir., 1866.
[5] Exostose . . . occupant la Fosse nasale gauche, Mém. de l'Acad. de Méd., 1865–66.
[6] Sur les Tumeurs osseuses des Fosses nasales, Thèse de Paris, 1869.
[7] Des Ostéomes de l'Organe de l'Olfaction, Thèse de Paris, 1869.
[8] Des Ostéomes des Fosses nasales, Arch. Gén. de Méd., Août, 1870.
[9] Traité Elém. de Pathologie externe, Paris, 1877, tom iii., p. 839 et seq.
[10] Dict. Encyclop. des Sciences Méd , 2e série, t. xiii., p. 169 et seq.

as a rule, is covered with mucous membrane of a bright pink color, but its surface is occasionally dark red or even purple in hue. At times the membrane is discolored or even ulcerated, and, in some instances, necrosed bone becomes visible. Owing to the ulceration or necrosis, or to the mere retention of the secretions which the tumor causes, there is usually a fetid discharge. As the growth enlarges, it may press on the septum, twist the nose to one side, and entirely obliterate the genio-nasal furrow; or, extending toward the antrum or the orbit it will produce corresponding deformities, such as unnatural fullness of the cheek, or displacement of the eyeball. The pain in most cases becomes extremely severe, but occasionally the pressure produces anæsthesia of the adjoining parts.

Diagnosis.—A nasal calculus or an exostosis may simulate an osteoma in the earliest stage of the affection. It should therefore be remembered that osteomata, unlike bony outgrowths, can at the outset be removed when pressed on with a strong probe, and that their surface cannot generally be broken with a sharp needle, as is the case with a calculus. When, however, an osteoma is encrusted with calcareous deposit, as is the case of Legouest,[1] the diagnosis is rendered extremely difficult. Enlargement of the turbinated bodies might by an inexperienced observer be mistaken for an osteoma, but while the latter is almost always unilateral, thickening of the turbinated bodies almost invariably affects both sides. Moreover, the tissues over the spongy bones are soft, and quite unlike the structure of osteomata. As the disease develops, the severe pain caused by the pressure of the hard mass at once differentiates osteomata from any other kind of nasal tumor except cancer, from which, again, they may be distinguished by their much slower rate of growth. Fibrous tumors of the nose are so rare that they need scarcely be taken into consideration, but an offshoot from a naso-pharyngeal polypus into one of the nasal fossæ might possibly be mistaken for an osteoma unless the naso-pharynx were explored. A digital examination of the posterior nares will, however, soon settle the question. Occasionally a mucous polypus may coexist with an osteoma, and this may further complicate the diagnosis.[2]

Pathology.—The tumors are of two kinds—the ivory and the cancellous. The former are much the more common, and they are so extremely firm in structure that the strongest forceps are sometimes turned by them. They are covered with periosteum, and well supplied with vessels, which pass into the substance of the tumor. They are generally connected with the soft tissues of the nose by a narrow pedicle. Although they appear to originate from the mucous membrane, it is more probable that they really grow from the periosteum, or that they commence as exostoses, their bony connection with the skeleton being destroyed at so early a period that it has never been observed. It is possible also that in some cases they may be originally of cartilaginous structure, and subsequently undergo ossification. On section these growths are seen to consist of a number of layers of bone which correspond with the depressions and elevations on their surface. The cancellous osteomata, as a rule, present the usual structure of cancellous bones—that is to say, they consist of an external envelope of compact tissue, with spongy tissue internally, between the trabeculæ of which is contained the ordinary reddish marrow; toward the centre of the bone there is often a distinct cavity.[3]

Prognosis.—The prospects of the patient are very favorable if the

[1] Loc. cit. [2] Legouest: Loc. cit.
[3] Richet: Bull. de l'Acad. de Méd, 1871.

tumor can be removed *per vias naturales ;* but, if not, the observation made under the head of "Prognosis" in the last article also applies here.

Treatment.—The only treatment is extirpation. The cancellous osteomata can be easily crushed with strong forceps and removed in fragments, while in the case of the ivory-like growths, it is generally necessary to lay open the nose. Rouge's operation (see Fibrous Polypi of the Naso-pharynx) should be performed in the first instance, but if sufficient room cannot be obtained in this way, one of the other methods described in the same article should be adopted.

Exostoses of the Nose.[1]

Exostoses are not very uncommon, though they seldom attain a large size, and hence do not give rise to much inconvenience. My clinical experience had led me to believe that they most commonly spring from the floor of the nose, a short way from the orifice. This, however, is not confirmed by observations made on preserved crania, for among 2,152 skulls in the Museum of the College of Surgeons, I found 170 examples of bony outgrowth originating from the septum, 91 being in the left, 79 in the right nasal fossa. In three of these cases there were two distinct exostoses, both, however, being in each instance in the same nasal fossa. The size varied from a split pea to half a haricot bean, and they sprang, as a rule, by a broad base from the septum, extending horizontally toward the outer wall and terminating in a more or less pointed crest. The situation of the tumor was generally opposite the middle turbinated bone, or just midway between that and the lower bone, so that the peak seemed in some cases actually to run into the orifice by which the antrum communicates with the middle meatus ; in a minority of instances the exostosis was opposite the lower turbinated bone. In many cases these prominences formed, as it were, the posterior spur of a bony ridge running along the septum at the junction of the ethmoid and the vomer, or of the latter and the crest of the upper maxilla. Ridges of this kind existed in 673 skulls (31.2 per cent. of the total number examined). In 375 instances the projection was on the left side ; in 231 on the right ; while in 67 cases there were ridges on both sides. The size varied from a slightly raised line to a rough jagged ledge encroaching considerably on the cavity of the corresponding nasal fossa. It is probable that in most cases a considerable portion of the ridge would be visible from the front (see Fig. 86, *c*). According to Thudichum,[2] exostoses sometimes grow from the turbinated bones, but this must be extremely rare, since in the large number of skulls above mentioned I only met with one example. In that case the growth sprang from the middle turbinated bone and ran horizontally across the nasal fossa almost to the septum.

Exostoses present an irregular surface, and occasionally cause slight deviation of the septum. It will be found impossible to penetrate them with a sharp needle, a peculiarity which serves to differentiate them from the softer tumors. I have never met with any instance in which the outgrowth caused serious inconvenience, but no doubt cases occur in which, by blocking up the antrum, it may give rise to disease within that cavity,

[1] A few forms of exostoses of rare kinds will be referred to under the head of Synechiæ.

[2] Lancet, September, 1868.

and there may be others in which smaller exostoses cause considerable irritation by their presence. If it is thought advisable to interfere with them, bony outgrowths would probably be best treated by means of the dentist's drill, as recommended by Goodwillie,[1] of New York. Thudichum states that they can be removed by means of the electric cautery wire, but I quite agree with Spencer Watson,[2] who points out the disadvantages of this mode of treatment in these cases, and remarks that "a pair of scissors would answer equally well, or even better." The projecting piece of bone, when small, can also be easily broken off with the common polypus-forceps; when it is large and is attached to the septum by a broad base my nasal bone-forceps (Fig. 55, p. 187) will be found most serviceable.

MALIGNANT TUMORS OF THE NOSE.

Latin Eq.—Tumores maligni nasi.
French Eq.—Tumeurs malignes du nez.
German Eq.—Bösartige Geschwülste der Nase.
Italian Eq.—Tumori maligni del naso.

Definition.—Malignant neoplasms, mostly of sarcomatous, more rarely of carcinomatous, nature, originating as a rule from the septum, but occasionally from the outer wall or the floor of the nasal fossæ, giving rise to obstruction of the nostril, muco-purulent discharge often offensive in character, and epistaxis, tending as they increase in volume to encroach upon the adjoining parts, leading in some cases to secondary deposits in other organs, and finally to cachexia and death.

History.—All the old writers who treat of nasal polypi state that these growths are sometimes of malignant nature. Among the five varieties of polypi described by Hippocrates[3] there is one which he calls a "kind of cancer." He mentions that this form of tumor is found "on the side of the cartilage near its extremity," and the treatment indicated is destruction with the hot iron, and subsequent dressing with powdered hellebore and "flower of copper" boiled in honey. Celsus[4] was strongly opposed to any interference with a class of nasal polypi which he described as of malignant nature, and only likely to be made worse by treatment. Abulcasis[5] described cancerous polypus under the name of "scorpion," and other mediæval writers, such as William of Salicet,[6] Rogerius,[7] and Bruno Longoburgensis,[8] expressly distinguished between simple nasal polypi and those of malignant nature. Ambroise Paré[9] reproduced Hippocrates' five classes of nasal polypi, and his description of their various characters, including, of course, the malignant kind. Glandorp[10] merely echoed the general opinion of antiquity in deprecating any interference with cancer of the nose except by way of pallia-

[1] New York Med. Record, November 12, 1881.
[2] Diseases of the Nose, London, 1875, p. 290.
[3] De morbis, lib. ii., Littré's edition, Paris, 1851, vol. vii., p. 53.
[4] De medicinâ, lib. vi., cap. viii.
[5] La Chirurgie d'Abulcasis, lib. ii., c. xxiv., Trad. du Dr. Lucien Leclerc, Paris, 1861, p 93.
[6] Chirurgia Guilielmi de Saliceto, lib. i., cxvii. Venetiis, 1546.
[7] Rogerii medici celeberrimi Chirurgia, cxxxiii., De cancro qui fit in naribus.
[8] Bruni Longoburgensis Chirurgia magna, lib. ii., c. ii., De polypo. Venetiis, 1546.
[9] Œuvres Complètes, livr. 6, ch. ii., vol. i., p. 378 of Malgaigne's edition. Paris, 1840. The distinguished editor appears to have been under the impression that this classification of Paré's was original (see note, ibid., p. 379).
[10] Tractatus de polypo, narium affectu gravissimo, observationibus illustratus, Bremæ, 1628, cap. xvii., p. 47 et seq.

tion. Pott[1] was emphatic in condemning any attempt at operation in the case of malignant nasal polypi, saying that he had seen an "untoward-looking polypus so attached to a distempered septum" that they were both pulled away together by the surgeon's forceps. Cases of undoubted cancerous growths in the nose were reported by Palletta[2] and Gerdy.[3] Syme[4] strongly disapproved of any interference with malignant nasal growths, except when the substance is so soft that it can be scooped out with the finger. In recent times cases of sarcoma of the nasal fossæ have been published by Fayrer,[5] Viennois,[6] Mason,[7] Grynfeldt,[8] Duplay,[9] and Hopmann,[10] while examples of epitheliomatous disease of the same cavities have been met with by Verneuil[11] and Péan.[12] Duplay[13] mentions a case of encephaloid cancer of the septum, which was mistaken for an abscess; and a case of medullary carcinoma of the nasal passages was reported by Neumann.[14]

Etiology.—Malignant disease of the nasal fossæ is not of frequent occurrence, carcinoma in particular being extremely rare in this situation. Its causation is as obscure as that of cancer or sarcoma in other parts of the body. Although in most of the cases on record the patients have been women, the number is too small to form a trustworthy index as to the relative liability of the sexes. It is possible that syphilitic ulceration may sometimes lead to the development of malignant disease, but this has received little confirmation from clinical facts. The only reported instance, so far as I am aware, in which such a relation appears probable, is that of Neumann. This was a case of medullary carcinoma, occurring in a woman whose age is not stated; there had been complete occlusion of the nostrils for eleven years, and there were also signs of former syphilitic ulceration of the throat. There was hypertrophy of the mucous membrane covering the turbinated bones, and on removal one portion of the redundant tissue was proved to be malignant. In this case I think it is clear that the disease had only recently assumed a malignant character.

Symptoms.—There is at first nothing more than the symptoms common to all growths in the nasal fossæ, viz., obstruction to the free passage of air through the channel, with the usual alteration of the voice and impairment of the sense of smell. There is also some discharge from the nostril, which is often of a greenish tint, and extremely fetid. Frequent and severe epistaxis takes place in most cases, and great pain is often complained of in the infra-orbital region. As the tumor increases in size, the bones forming the bridge of the nose may be pushed forward or separated from each other, and protrusion of the eyeball may be caused by pressure on the inner wall of the orbit; or the base of the skull may be eroded, and even perforated, by the upward growth of the tumor. In one of Gerdy's cases, nothing remained of the ethmoid bone but the crista galli, while in another, related by Paletta,[15] the cribriform plate of the same bone was destroyed, and the diseased mass extended into the brain. It is

[1] Some Remarks on the Polypus of the Nose, in Chirurgical Observations, London, 1775, p. 59.
[2] Exercitat. pathol., Mediolani, 1820, p. 1 et seq.
[3] Traité des Polypus. Paris, 1833.
[4] Principles of Surgery, p. 493.
[5] Medical Times, July 4, 1868.
[6] Lyon Médical, 1872, No. 18.
[7] Medical Times, May 22, 1875.
[8] Montpellier Médical, October and December, 1876.
[9] Traité Elém. de Pathologie externe, Paris, 1877, t. iii., p. 846.
[10] Virchow's Archiv, Bd. xciii., 1883.
[11] Bonheben: De l'Extirpation de la Glande et des Ganglions sous-maxillaires, Thèse de Paris, 1873.
[12] Quoted by Casabianca: Des Affections de la Cloison des Fosses nasales, Paris, 1876, p. 67 et seq.
[13] Op. cit., t. iii., p. 788.
[14] Oesterr. Zeitschr. f. prakt. Heilk., 1858, iv., 17.
[15] Op. cit., pp. 7, 8.

obvious that, under such circumstances, cerebral symptoms are likely to occur, while if the growth extends backward through the posterior nares, deafness, dysphagia, and difficulty of breathing may be caused.

Although malignant tumors most frequently originate from the septum, they may spring from any part of the interior of the nose, and Viennois states that he has twice seen melanotic sarcoma develop from the ala. In one of the cases reported by Gerdy, several polypi of malignant nature were found on dissection growing from the pituitary membrane covering the spongy bones, while in another a large malignant mass was seen to spring from the mucous lining of one of the sphenoidal cells.

The tumors vary in size from a pea to an orange, though of course they may attain to much greater dimensions if not interfered with. Sarcomata, unlike simple polypi, are generally single and sessile; they are soft, smooth, and usually pinkish in hue, though sometimes dark brown, or even black. They are highly vascular, and bleed easily when touched. Cancerous formation mostly begin as small warts or pimples, which are reddish in color, and usually very soft and friable. In Péan's case, the growth, although proved to be distinctly epitheliomatous in character, had a kind of pedicle, but this is quite exceptional. As a rule, such tumors show a marked tendency to ulcerate, the ulcer presenting the well-known raised, hard, ragged edges, and sanious base; after a time there is enlargement of the neighboring lymphatic glands, especially of those lying below the ramus of the lower jaw. Sarcomata are characterized by extreme rapidity of growth, and both forms of disease show a marked tendency to recur after removal.

Diagnosis.—The recognition of malignant tumors of the nasal fossæ is not always easy in the early stage of their development. There is little likelihood, however, even at the outset, of their being confounded with mucous polypi, as the latter are nearly always attached by a pedicle to the outer wall of the nasal cavity, while malignant tumors, in the great majority of cases, grow from the septum by a broad base. When the disease is advanced it bears no resemblance to the benign growth. Though originating from the septum, the density of the swellings, the absence of fluctuation, and the frequent ulceration of their surface, will serve to distinguish them from septal abscess. Cartilaginous or osseous tumors may be mistaken for malignant growths, but in most cases the extreme hardness, together with their slow increase in size, and the permanently local nature of the affection, should guide the surgeon to a right conclusion.

Rhinoliths and impacted foreign bodies should not be forgotten in examining tumors of the nose, but the former are often movable, while their calcareous surface can generally be recognized on scraping, and they can often be made to sound when struck with the probe; in the case of foreign bodies, on the other hand, the symptoms are not progressive, and the patients are mostly children. Great rapidity of growth, particularly after partial removal, is a well-marked, if not quite distinctive, feature of sarcomatous tumors, while epithelioma not unfrequently gives rise to general constitutional infection and cachexy. In all cases, however, which present the least doubt, the nature of the growth should be established by microscopic examination of a small portion of its substance.

Prognosis.—In carcinoma of the nasal fossæ the chance of the patient's ultimate recovery is as hopeless as in cancer of any other part of the body; but in the case of sarcoma there appears to be some ground for belief that if the disease be treated early and thoroughly, the prognosis is not absolutely bad. While these sheets are passing through the press, as an

illustration of this I may mention that I have had an opportunity of seeing a patient from whom Mr. Francis Mason removed a mass of myeloid sarcoma attached to the septum. The ala was raised by means of an incision carried downward along the side of the nose, and the tumor completely taken away, the raw surface being then saturated with a solution of chloride of zinc (gr. xl. ad ℥ j.). Although the man is sixty-seven years of age, and has never been very healthy, there is no appearance of recurrence of disease in the nose, though the operation was done more than seven years ago.

Pathology.—Concerning the pathology of these tumors, little need be said in this place. Both sarcomatous and cancerous polypi offer the characters common to such neoplasms in other regions of the body.

Treatment.—The only proper method of treating malignant disease of the nasal fossæ consists in the thorough removal of the growth where practicable. The plan of procedure to be pursued, however, should be carefully considered, as the difficulties of exposing a tumor in these intricate chambers sufficiently to allow of its complete extirpation are very great, and partial removal only aggravates the mischief. A "preliminary operation" (see Fibrous Polypi of the Naso-pharynx) is always necessary.

Often the disease has reached such a stage before the patient comes under treatment, that only palliative measures are applicable. Local astringents are sometimes of use in this way by causing temporary shrinking of the mass, and I have occasionally found electric cautery serviceable in restraining hemorrhage. This was notably the case in a patient whom I recently treated with Dr. Slimon, of Bow, where bleeding was a very troublesome feature.

SYPHILITIC AFFECTIONS OF THE NOSE.[1]

Latin Eq.—Mala venerea nasi.
French Eq.—Affections syphilitiques du nez.
German Eq.—Nasensyphilis.
Italian Eq.—Malattie sifilitiche del naso.

Definition.—The local manifestation in the interior of the nose of constitutional syphilis in its so-called primary, secondary, tertiary, and congenital forms, giving rise in mild cases to slight obstruction of the nasal channels by swelling of the mucous membrane, and in severe cases to extensive ulceration and necrosis of the bones which may end in more or less complete destruction of the framework of the nose.

History.—A graphic and fairly accurate description of nasal syphilis is to be found in the writings of the Chinese emperor Hoang-ty,[2] which date from more than 2,600 years before Christ. Severe swelling, coryza, ulceration, ozæna, and partial or complete destruction of the nose are there described as being among the consequences of a virulent sore on the genitals. This ancient writer also appears to have been acquainted

[1] Syphilitic lesions of the naso-pharyngeal region will be considered further on in the section on Throat-Deafness. This arrangement appears the most convenient, as the nasal phenomena in such cases are usually of quite secondary importance as compared with the aural symptoms caused by the disease attacking the Eustachian tube.

[2] See Fabry: La Médecine chez les Chinois, Paris, 1863, p. 260 et seq.

with infantile syphilis as it affects the nose. In the writings of Susruta,[1] together with a description of other unmistakable syphilitic lesions, there is an account of certain nasal disorders due to the same constitutional poison. Doubtless many of the severe affections of the nose described under the general name of *ozæna* by the Greek and Roman writers (see Dry Catarrh, pp. 225, 226) were of syphilitic origin, but no suspicion of such a relation is shown by these authors. Dion Chrysostome,[2] however, possibly intended to allude to syphilis of the nose in the following passage: "They say that Aphrodite, to punish the women of Lesbos, inflicted upon them a disease of the armpits: it is thus that the Divine anger has destroyed the noses of the greater number among you." After the terrible outburst of the venereal plague that followed the return of Columbus and his companions in 1496, specific disease of the nose was distinctly recognized by physicians,[3] and the disfigurements of the unlucky feature that often ensued became a favorite subject of jesting among poets and satirists. Possibly this, as well as other serious results of syphilitic inoculation, were more common formerly than at the present day when the treatment of the disease is better understood. In recent years the introduction of the sharp curette by Volkmann[4] has made an important advance in treatment in the more serious cases. In 1876 a pamphlet was published by Clinton Wagner,[5] which contains some useful hints as to the treatment of nasal syphilis, and in the following year Schuster[6] wrote a valuable practical paper, detailing the highly favorable results which he had obtained by Volkmann's plan of treatment, and containing, moreover, a most important contribution to the pathology of the affection by Sänger.

Etiology.—An instance of primary syphilitic chancre of the nostril has been related by Spencer Watson.[7] The patient was a nurse in attendance on a lady who gave birth to a syphilitic child. The sore could not be distinctly seen, but there was a swelling within the nostril, accompanied by severe pain, fever, and mental depression. The ordinary secondary symptoms followed in due course. The vehicle of infection in this case was probably the patient's own finger. The causes which predispose the nose to attacks of the secondary and later forms of syphilis are unknown, but it is probable that, in persons suffering from venereal disease, chronic catarrh, or any other accidental affection of the nose tends to localize the poison. The strumous diathesis also seems to render its subjects particularly liable to severe forms of nasal syphilis. Extreme cachexia often coexists with the more advanced tertiary lesions of the nose, but it is difficult to say whether this is a cause or a consequence of the local mischief. There seems to be much less liability to the disease at the present time than formerly. It appears, however, that in countries where syphilis has been allowed for centuries to rage without the mitigation of rational treat-

[1] A'yurvedas, Nidânasthâna, cap. ii. Translated by Hessler. Erlangen, 1844–50. This Indian treatise on medicine, which probably dates from about B.C. 600, is a compilation by Susruta from the teaching of his master D'hanvantare. It has been suggested (Khory: Digest of the Principles and Practice of Medicine, London, 1879, Preface, p. vi.) that the work is merely a Sanskrit version of some of the Hipprocratic writings, but there appears to be no real foundation for such a statement; and, indeed, the works present no similarity either in matter or form.

[2] Orationes ex recens. J. J. Reiskii, Leipsiæ, 1784, vol. ii., orat. 33. (Quoted by Lancereaux, Treatise on Syphilis, Syd. Soc. Transl., 1868, vol. i., p. 15.)

[3] As nearly every author who treats of syphilis mentions the nasal form of the affection, it seems unnecessary to give a detailed history of the subject. The reader may be referred to the enormous collection of writers on venereal disease contained in the Aphrodisiacus, first published by Aloysius Luisini, at Venice, in 1599, republished and enlarged up to date by Langerak, at Leyden, in 1728, and continued by Gruner down to 1793.

[4] Ueber d. Gebrauch d. scharfen Löffels, etc., Halle, 1872; and Beiträge z. Chirurgie, Leipzig, 1875, p. 267.

[5] Syphilis of the Nose and Larynx. Columbus, Ohio, 1876.

[6] Beiträge z. Pathologie u. Therapie der Nasensyphilis, von Dr. Schuster u. Dr. Sänger. Vierteljahrsschr. für Dermatol. u. Syphilis, 1877, 1. u. 2. Heft, and Ibid., 1878.

[7] Med. Times and Gaz., 1881, vol. i., p. 428.

ment, the disorder retains an extraordinary virulence, and shows a strong tendency not only to attack the nose, but to do so at a very early period. The fact of rapid development of tertiary symptoms is well illustrated by the cases of some patients received at the Val de Grâce Hospital in Paris on the return of the French troops from Mexico.[1] The disease had been caught from native women, and in two cases severe tertiary symptoms showed themselves within a year, while in a third they occurred in less than six months from the date of inoculation. Among the modern Arabs, symptoms which in Europe would be called tertiary, not unfrequently come on almost at once, the face, and especially the nose, being the most common point of attack. In Europe, secondary syphilis of the nose is generally met with from three to nine months after the primary sore, while tertiary lesions are very seldom noticed until some years after the inoculation of the poison. An exceptional case, however, is related by Mauriac,[2] in which the patient, who had contracted syphilis in Paris, suffered from necrosis of the nasal bones in the seventh month from the appearance of the disease.

Secondary phenomena are either rare in the nasal fossæ, or they are frequently overlooked. Davasse and Deville[3] found mucous patches in the nose in 8 out of 186 cases occurring in women, the tonsils having been affected 19 times in the same series. Bassereau,[4] on the other hand, in 110 male patients found mucous patches at the edge of the nostrils only twice, the tonsils being affected in no less than 100 instances. The experience of Bassereau accords much more nearly with my own than that of the first-named observers. At the Val de Grâce in Paris,[5] only 1 per cent. of the cases treated during five consecutive years showed secondary syphilides of the nose. Tertiary lesions are more common, but even these appear to be rare at the present day, for Willigk[6] met with only 2.8 per cent. in 218 cases.

Symptoms.—The phenomena of nasal syphilis vary according to the stage and severity of the disorder. In the seconday period there is generally nothing more than hyperæmia of the mucous membrane, producing symptoms of somewhat intractable catarrh. Sometimes, however, mucous patches can be seen at the external angle of the nostrils, or just inside the nasal fossæ, either on the septum at its anterior part, or on the inferior turbinated body. Similar patches may also be visible, with the aid of the rhinoscope, on the margins of the posterior nares. These lesions sometimes give rise to intractable coryza, with muco-purulent secretion, while at the same time roseolar eruptions appear on the skin. In tertiary syphilis perforation of the septum not infrequently takes place, and the carious bone exhales a horribly offensive odor, to which the term "ozæna," now limited to certain forms of dry catarrh (see p. 229), was formerly applied. In such cases the discharge from the nose is generally abundant, and is often of a blackish color, and the most careful washing away of the discharge by irrigation or spraying fails to get rid of the stench. Should the vomer be extensively involved, the bridge of the nose may fall in, causing a characteristic flattening, as if the organ had been crushed, while if the cartilaginous portion of the septum is destroyed, the tip of the nose sinks in and becomes flattened, and hangs loosely from the bony part of the

[1] Spillmann: Dict. Encyclopéd. des Sciences Médicales, t. xiii., 1me part, p. 39.
[2] Syphilose pharyngo-nasale, Union Médicale, 1877, t. i., p. 342.
[3] Quoted by Lancereaux: Treatise on Syphilis, Syd. Soc. Transl., London, 1868, vol. i., p. 174 et seq.
[4] Ibid., p. 175.
[5] Spillmann: Op. cit., p. 38.
[6] Prager Vierteljahrsschr., 1856, xxiii., 2, p. 20.

nose (Fig. 85). Occasionally the whole substance and framework of the feature is disintegrated, and it is represented only by two small apertures surrounded by cicatricial tissue. The disease may extend to the superior maxilla, may destroy the bony walls of the lachrymal canal, or slowly eat away large portions of the ethmoid and sphenoid bones, the basilar process of the occipital bone may entirely perish by slow caries, or large pieces of these bones may be thrown off by rapid necrosis. The cranial cavity is indeed sometimes laid open, and, if this occurs, it is generally soon followed by fatal inflammation of the brain and its membranes. In a case related by Trousseau,[1] a large piece of the ethmoid, constituting about a quarter of the entire bone, almost suffocated a patient by falling unexpectedly into his throat. He died on the following day with acute cerebral symptoms, due, no doubt, to the disease having spread to the brain or its coverings. Brodie[2] and Graves[3] mention instances in which the disorder, having extended through the cribriform plate of the ethmoid, gave rise to epileptiform and maniacal convulsions which terminated fatally. A case, however, has been recently reported by Baratoux[4] in which almost the entire body of the sphenoid was expelled from the nose without any signs of cerebral mischief having been observed.

FIG. 85.—Flattening of the nose from destruction of the cartilaginous septum by syphilitic disease.

On examination of the nose in cases of tertiary syphilis, deep foul ulcers with ragged edges and dirty grayish bases can often be made out. When caries exists the part over the diseased bone generally appears blackish in color, the surface being rough and uneven. Occasionally, however, nothing can be perceived beyond dark-colored crusts and greenish-yellow mucus, by which the true condition of the underlying tissues is quite concealed. In other cases the pieces of dead bone may be situated so high up in the nasal cavity that nothing can be seen, but even then the probe will sometimes serve to discover them. Now and then, however, the most careful observation may fail to disclose the actual seat of disease, as is well shown by some cases reported by E. Fränkel (see Pathology).

Diagnosis.—There is seldom much difficulty in recognizing the affection, the only disease with which it can be confounded being lupus exedens when that disorder commences *within* the nose. The age, however, at which lupus begins will generally serve to distinguish it, showing itself, as it does, earlier than any form of syphilis except the hereditary disease, which, on the other hand, has symptoms quite peculiar to itself. Moreover, even at a very early period, the papules or tubercles of lupus are sufficient to identify it, while, later on, the marked preference which the

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[1] Clinique Médicale de l'Hotel-Dieu, Paris, 1868, t. i., p. 546.
[2] London Med. Gazette, 1844.
[3] Clinical Lectures, vol. ii., p. 484.
[4] Archivii Italiani di Laringologia, Anno iii., July 15, 1883, pp. 19–21.

morbid process shows for the *cartilages* is very characteristic. Dry catarrh accompanied by ozæna is sometimes mistaken for syphilitic caries, but to those who have had any experience the smell is quite different; moreover, the stench of true ozæna can be got rid of by syringing, while the most persevering irrigation leaves the odor arising from diseased bone comparatively unaffected. Should any doubt arise, however, the use of Gottstein's plugs will settle the question, for while they quickly put an end to the stench in true ozæna, they greatly intensify it if there is any necrosis or caries.

It is important to remark here that though perforation of the septum far more often results from tertiary syphilis than from any other cause, it is by no means, as is often supposed, an exclusively syphilitic lesion. Leaving congenital deformity and injury out of the question, a permanent hole may result both from septal abscess and blood-cyst, and possibly also from tubercular ulceration (see Tubercular Disease of the Pituitary Membrane, p. 283).[1] I dwell on this matter with some emphasis, as I have known painful mistakes made through ignorance of the facts just mentioned.

In all doubtful cases the previous history should be carefully inquired into, the skin should be examined for coppery patches, periosteal nodes sought for in the usual situations, while cicatrices and induration should be looked for in the tongue, pharynx, and larynx. In the absence of other evidences, the action of iodide of potassium will generally soon determine the nature of the case.

Pathology.—Sänger,[2] who examined several specimens of polypoid excrescences removed by Schuster from the nasal fossæ of patients affected with syphilis, arrived at the following results: The mucous membrane at one spot was greatly hypertrophied as regards all its elements, and the fold thus formed tended to increase in size as the process continued, and finally, being acted on by gravitation, became pendulous. On section, the mass presented two clearly-defined structural zones, first, an inner or erectile one, consisting of a network of venous capillaries, surrounded by connective tissue of dense fibrillar structure, and enclosing acinous mucous follicles, the lobes of which appeared to be encroached upon by the neighboring tissue, and were undergoing atrophy; second, an outer cortical zone, consisting of an enormous number of small round cells, uniform in size, and lying closely packed together in a stroma of very delicate areolar tissue. These cells had each a nucleus, and often several nucleoli, and were surrounded by blood-vessels, the coats of which they had, in some places, partly penetrated. Covering the cortical zone was epithelium of the cylindrical non-ciliated variety. In some parts, this epithelium had disappeared, leaving microscopic excoriations, and at those points the round cells were especially numerous. From these appearances Sänger infers that the process had consisted in a primary hypertrophy of the mucous membrane with its vessels and glands, followed by formation of small round cells at the periphery of the tumor, which by gradually encroaching on the vessels and follicles, produced obliteration of their channels at one part, with corresponding dilatation farther back. In this manner the cortical layer of round cells and the erectile zone of dilated venous spaces had been formed. That this infiltration of the mucous membrane by proliferating small round cells is distinctively syphilitic, was

[1] See also perforation of the septum in typhoid fever and acute rheumatism (p. 294).
[2] Loc. cit.

proved by comparison of the sections with others of undoubted syphilitic products found in the intestines. Sänger also concluded, from other specimens, that a similar infiltration of the mucous membrane with proliferating small round cells may take place without hypertrophy of the mucous membrane itself. In all cases the cellular infiltration extended some way into the neighboring tissues, so that no definite boundary could be traced. In other instances, true syphilitic neoplasms (condylomata) were found, the mucous membrane itself being entirely altered in structure, and the epithelium either altogether absent, or reduced to a few layers of poorly nourished cells. The changes presented by the cartilages and bones at points corresponding to the infiltrated patches of mucous membrane consisted—first, in exfoliating necrosis, resulting from suppuration; second, in rarefying syphilitic osteitis or *caries sicca*, the bone having been absorbed and replaced by exuberant granulations of the mucous membrane; and third, in rarefying and plastic osteitis, the connective tissue of the periosteum and the bone having been transformed into spindle-shaped cells, which had become partly organized again into ordinary connective tissue, and partly into new bone.

Sänger points out that the view commonly held, that ulceration of the nasal mucous membrane is a necessary antecedent of caries of the underlying bones and cartilages is erroneous, and he maintains, on the contrary, that the bony framework of the nose may be the primary seat of syphilitic caries, in the same way that the frontal bone or the tibia may be attacked by primary syphilitic periostitis.

It should be borne in mind, as pointed out by E. Fränkel,[1] from the post-mortem inspection of three cases, that the necrosis of bone may be molecular, the ulcerations being so minute as altogether to escape observation during life. Fränkel found cirrhotic thickening of the mucous membrane, with partial absorption of the glandulæ, in addition to the disease of the bone.

Prognosis.—In secondary syphilis, and in mild tertiary disease, where the destruction has been slight and the bodily vigor of the patient is but little diminished, recovery is almost certain to take place under a well-directed course of anti-syphilitic treatment. When, however, active caries is going on, the prognosis is necessarily grave, especially if, as is common in such cases, the patient is in a very exhausted condition.

Treatment.—Syphilitic coryza in the adult rapidly passes away. An ordinary tonic may be given, while, locally, the use of a nasal wash of bicarbonate of soda or permanganate of potash will generally effect a cure in a week or two. When *condylomata* are present, they should be touched with tincture of iodine or solid nitrate of silver. In *tertiary syphilis*, more active treatment is required, and constitutional and local measures are alike essential. Iodide of potassium must be given, the dose being gradually increased to ten or fifteen grains three times a day. If this drug, after being fairly tried for some months, fails to bring about a cure, or produces but slight benefit, mercury must be resorted to, either alone or in combination with iodide of potassium. Small doses of the corrosive sublimate may be given twice or three times a day in a decoction of sarsaparilla, or the cyanide of mercury may be administered twice a day in the form of a pill.[2] Considerable advantage will often be found in alternating the remedies. Thus, a case which has improved up to a certain point

[1] Virchow's Archiv., Bd. lxxv., 1 Heft, 1879.

[2] ℞. Hydrarg. cyanid., gr. $\frac{1}{10}$; Sacch. lactis, gr. $\frac{3}{4}$; Tragacanth, q. s.; M. ft. pil.

under iodide of potassium, will generally make some further progress under the influence of mercury, while, after a short interval, a return to the iodide will often be attended with very marked and rapid improvement of the symptoms. When there is cachexia, analeptic treatment must, of course, be assiduously carried out.

In all tertiary forms of the affection, local measures are useful, and, indeed, frequently essential. In cases of caries of the bony structures, with foul-smelling discharge, the nasal cavity should be thoroughly cleansed two or three times a day with a lotion of detergent and deodorizing character. Any superficial ulcers which may exist within the nose will be soon brought into a healthy condition by these washes ; but, for deep, spreading ulcers, more concentrated remedies are necessary. For this purpose, nitrate of silver, fused on the end of a piece of aluminium wire, suitably curved, may be used. In intractable cases, however, the daily application to the ulcer of iodoform, by means of an insufflator, will often effect a cure where more severe measures have failed. At the same time, stimulating and antiseptic inhalations, such as the Vapor Iodi, V. Creasoti, or V. Pini Sylvestris of the Throat Hospital Pharmacopœia, may be inspired through the nose, or antiseptic sprays may be employed. Dead bone should be removed with suitable forceps *when the fragments are loose* and within view, but it is highly dangerous to use much force in detaching sequestra. Schuster [1] has found the greatest benefit in cases of obstinate ulceration from the free use of Volkmann's sharp spoons (Fig. 66, p. 193), even when no exposed bone could be detected with the sound. The ulcers are first scraped, and afterward any indurated tissue that may remain is destroyed with nitrate of silver or electric cautery. Schuster's experience agrees with Volkmann's [2] own on this point, viz., that it is precisely in the most severe and apparently hopeless cases of extensive destruction of the bony framework of the nose that treatment with the sharp curette yields the most brilliant results. I have employed these sharp spoons in a few instances, but always with the greatest care. Their use is not altogether free from danger, a case having recently been brought to my knowledge in which death occurred from hemorrhage while the surgeon was scraping out the nasal fossæ of a patient suffering from syphilitic necrosis.

When the diseased bone cannot be seen by the ordinary methods of examination, while the symptoms are urgent, it may be advisable to expose the interior of the nose in order to apply strong remedies directly to the affected part. Celsus [3] suggested the extreme measure of laying the nose completely open from the outside, but a sufficiently good view of the cavities and access to all their recesses may be obtained by Rouge's operation (see Fibrous Polypi of the Naso-pharynx).

Should the nose be completely destroyed, an attempt may be made to remedy the deformity by a rhinoplastic operation, for a detailed description of which the reader is referred to the ordinary text-books of surgery. Slighter disfigurement may be mitigated by an artificial nose.

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[1] Loc. cit.
[2] Beiträge zur Chirurgie, Leipzig, 1875, p. 267.
[3] De Medicinâ, lib. vii., cap. ii.

HEREDITARY SYPHILIS OF THE NOSE.

Hereditary syphilis is apt to attack the nose at two periods of life, viz., at the time of birth or soon after, and later on in childhood. Newly-born infants are, however, its especial victims, and in them the disease takes the form of severe catarrh. It generally appears within a week or two of birth, seldom commencing after the end of the second month. It is probably dependent, in most cases, on the presence of mucous patches on some portion of the pituitary membrane, although, as a rule, none can be seen. The discharge may be thin at first, but it usually soon becomes mucopurulent. The nasal channel becomes blocked up to such a degree that the troubles described in connection with acute catarrh in infants (see p. 204) as regards sucking and sleeping are often observed. From the swelling in the pituitary membrane and the accumulation and drying of the mucus, the nasal breathing becomes difficult and noisy, and a child thus affected is popularly said to have the "snuffles." The secretion irritates the margin of the nostrils and the upper lip, rendering the skin and the mucous membrane at those points red and excoriated. The malady is very chronic in its course, showing little or no inclination to subside spontaneously, and in most cases, if not subdued by treatment, it becomes gradually worse. If caries of the bones and cartilages of the nose ensues, the child is not unlikely to be disfigured for life by a flattened nose.

Where there is caries with discharge, the sudden spontaneous cessation of the secretion is ordinarily, according to Hermann Weber,[1] the precursor of a serious and often fatal brain-lesion. In one case related by that physician, as soon as the discharge ceased, cerebral symptoms showed themselves. Four days later the little patient was seized with rigors and well-marked signs of pyrexia, and on the thirteenth day from the first attack of shivering, death took place. At the post-mortem examination, thrombi were found in the cavernous sinus and left ophthalmic vein. There was evidence of severe meningitis, and the under surface of the left cerebral hemisphere was bathed in pus. Purulent collections were also found in the pleuræ, lungs, and liver.

Syphilitic children are mostly small and feeble, and have an aged, withered appearance. Their skin is of a grayish tint, if it be not covered with a copper-colored papular eruption or with *pemphigus neonatorum*. Sometimes the infants are apparently healthy at birth, the marasmus only coming on three or four weeks later. Mucous patches will generally be found at the anus, and often at the corners of the mouth and the margins of the eyelids.

Syphilitic coryza occurring in an infant requires both systemic and local *treatment*. Although in many cases of constitutional syphilis in adults I do not consider that mercury is necessary (see vol. i., Preface, and pp. 69, 70), yet, in this form of the disease, mercurial treatment appears to me to be the best that can be adopted, the administration of this drug having a very marked influence on the duration and intensity of the affection. It should be given to children in the form of gray powder in doses of from one to two grains twice a day, and if this is found to cause diarrhœa, one grain of Dover's powder or an additional grain of chalk should be combined with each dose of the gray powder. Erichsen[2] recommends

[1] Med.-Chir. Trans., vol. xliii., p. 177.

[2] Science and Art of Surgery, London, 1872, sixth edition, vol. i., p. 670.

the external application of mercury in the manner first proposed by Brodie, as the readiest way of introducing the remedy into the system of a syphilitic child. The following is the method: A drachm of mercurial ointment should be spread on a flannel roller, which should then be stitched round the child's thigh just above the knee, the medicated surface being next the skin. This ought to be renewed every day for a period of two or three weeks, after which iodide of potassium should be administered in milk or cod-liver oil.

Local treatment is also required almost always, but the difficulty of carrying this out in infants has led to its being much neglected, and the ravages of syphilis in the nose in such cases are largely due to this cause. The following is the best method of washing out the nasal passages of an infant: The child should be placed in the nurse's lap, and the naso-pharynx plugged by means of the temporary sponge-tampon (Fig. 74, p. 197). The little patient's head should then be slightly raised, and the nose washed out with a fine syringe, or, if it be preferred, a spray or nasal douche can be applied, care being taken in the latter case that too much force is not used. The Collunarium Acidi Carbolici cum Borace, or the C. Potassæ Permanganatis of the Throat Hospital Pharmacopœia, may be employed in half their usual strength.

TUBERCULAR DISEASE OF THE PITUITARY MEMBRANE.

Latin Eq.—Tubercula membranæ pituitariæ.
French Eq.—Tubercules de la membrane pituitaire.
German Eq.—Tuberkel der Membrana pituitaria.
Italian Eq.—Tubercoli della membrana pituitaria.

Definition.—A chronic affection of the nose, probably always preceded by tubercular disease of the lungs or other organs, arising from the deposit in the mucous membrane of tubercles which form tumors prone to ulceration.

History.—Very few examples of tubercular disease of the nasal mucous membrane have hitherto been recorded. In the year 1853 Willigk[1] mentioned that he had once found tuberculosis of the membrane covering the septum. In 1877 Laveran[2] described two cases; and in the following year Riedel[3] added two more. Volkmann[4] soon afterward briefly referred to the subject, and expressed a belief that many cases of supposed hereditary syphilis of the nose are really of a tubercular character. In 1880 Tornwaldt[5] published a very interesting example of the complaint; and more recently Weichselbaum[6] has given an elaborate pathological report on two cases which came under his notice.

Etiology.—Tubercular disease of the nasal mucous membrane is no doubt a very rare affection, but it is likely to be more carefully sought for in future, and in all probability some cases will be met with from time to

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[1] Prag. Vierteljahrsschrift, 1853, Bd. xxxviii.
[2] Union Médicale, Nos. 35 and 36.
[3] Deutsche Zeitschrift für Chirurgie, Bd. x.
[4] Sammlung klinischer Vorträge, Leipzig, 1879, No. 168–169, p. 31
[5] Deutsches Archiv für klin. Med., Bd. xxvii., p. 586.
[6] Allgemeine Wien. med. Zeitung, 1881, Nos. 27, 28.

time. As all these are tolerably sure to be reported, the complaint may in a few years appear to be much more common than it really is. Williglk found the disease once in 476 tuberculous bodies. Weichselbaum noticed only 2 examples in 146 autopsies of patients dying with tubercle. In 50 bodies of consumptive patients, which E. Fränkel[1] carefully examined by Schalle's method, the nasal cavity was in every case entirely free from tubercular disease. I have never observed a case of tuberculosis of the nasal mucous membrane, but I have no doubt that I have sometimes overlooked it among the thousands of cases of laryngeal phthisis which have come under my notice. I have, however, met with two instances in which there was a large perforation in the septum which may possibly have resulted from tubercular ulceration. There was no apparent cause for the lesion ; in particular, there was no history of syphilis, nor any trace of that complaint. Tubercular disease is probably always secondary, though in Tornwaldt's case the nasal symptoms preceded by a long time those subsequently developed in the larynx and lungs ; and in one of Riedel's cases, though the patient had a somewhat cachectic appearance, there were no physical signs of pulmonary tuberculosis nine months after the removal of a large tubercular tumor on the septum.

Symptoms.—Tubercular deposit in the mucous membrane of the nose may be seen either in the form of tumors, varying in size from a millet-seed to a bantam's egg, or there may be slight thickening and ulceration of the mucous membrane. In either case there is generally a troublesome and more or less fetid discharge. Though the deposit may occur at any part, it appears to show a preference for the septum. In Tornwaldt's case, however, the mucous membrane covering the turbinated bones was greatly hypertrophied, and there were two reddish-gray tumors of the shape and size of split peas. In Riedel's cases there were both tumors and ulcers. In one a raised ulcer near the left nasal orifice had partly destroyed the ala on that side, while in the other the ulcer had perforated the septum. In both instances large tumors occupied the septum. One was 2½ ctm. in length, 2 ctm. in height, and 1½ in thickness. In the other case there was a somewhat similar tumor, though considerably smaller in size. In both, the growths occupied the posterior part of the septum. Laveran found ulcers on the anterior part of the septum. They were about the size of a (silver) twenty-centime piece, of a grayish color, and not at all painful. In one of Weichselbaum's cases there were four small ulcers, varying in size from a hemp-seed to a lentil, all situated on the septum, while grayish-white nodules were also seen on that partition near the floor of the nose on the right side. Similar nodules were present on the vault of the pharynx, while several of the retro-pharyngeal glands had undergone cheesy degeneration. In Weichselbaum's second case the patient, a woman, aged sixty-two, had a soft yellowish-gray nodule of the size of a hemp-seed on the anterior extremity of the right inferior turbinated body. A grayish-white nodule as large as a poppy-seed was also seen on the anterior portion of the right middle meatus, and a small tumor about the size of a hemp-seed was situated at the anterior extremity of the left middle turbinated body. This small tumor was undergoing ulceration at its apex.

The progress of tubercular disease of the mucous membrane is generally slow, and in one of Riedel's cases the ulceration existed for twenty-seven years.

Diagnosis.—When obstinate ulceration or growths are found in the nose

[1] Archives of Otology, June, 1881, vol. x., No. 2.

of a person suffering from well-marked tubercle of another organ, it may be suspected that the nasal affection is of the same nature. Certainty, however, can only be arrived at by excising a portion of the mucous membrane or growth and submitting it to microscopic examination. If (lupus or glanders being excluded) clusters of lymphoid cells with giant cells in their centre are found in a reticular connective tissue, there can be no doubt of the presence of tubercle. The *absence* of giant cells is not, however, to be taken as disproving it.

Pathology.—Tubercle, when deposited in the mucous membrane of the nose, generally forms minute tumors, varying in size from a poppy to a hemp-seed; occasionally, however, large growths are formed, as in the cases reported by Riedel. The small tumors may be seen to be undergoing cheesy degeneration, and the mucous membrane covering them shows signs of softening and commencing ulceration. In Laveran's cases, tubercles and giant cells were found in the sub-epithelial stratum forming the base of the ulcers, and also in the tissues immediately surrounding them. The large tumors observed by Riedel consisted in the main of very vascular granulation-tissue. Gray nodules could be seen with the naked eye, which, microscopically, were found to "consist of masses of large cells, the centres of which did not contain the giant cells so constantly met with in lupus."

In Tornwaldt's case the portion of growth first excised was examined by Farne, of Dantzig. The specimen contained distinct groups of small nucleated cells, with several larger epithelioid cells in a reticular stroma. In two preparations giant cells could be clearly demonstrated. Other portions of the growth subsequently removed were examined by Baumgarten, with the assistance of Neumann. The following is their report: "We conjointly agree in stating that the specimen is, as you surmised, a tubercular node. In a tissue densely infiltrated with small round cells, circumscribed groups of larger epithelioid cells, containing in their centre (in scanty number, it is true) veritable giant cells are seen. The limited amount of the specimen affords some ground of objection to our diagnosis of tubercle."

The most detailed account of the microscopic appearance of tubercle in the nasal mucous membrane has been given by Weichselbaum. He states that the peripheral parts of the nodules are composed of lymphoid cells, which form larger or smaller groups, and present an interstitial structure of reticular connective tissue. Gland-tubes of various shapes, cut transversely, obliquely, and longitudinally, are scattered here and there in the round-celled mass. These represent the acini and excretory ducts of the follicles separated by the lymphoid infiltration. The lumen of many of the ducts is encroached upon by "epithelia of low type," while some of them, on the other hand, are over-distended by the quantity of round cells within them. The nodule may contain giant cells with oval peripheral nuclei, and a fine granular centre can be made out, or it may be in a state of cheesy degeneration, consisting merely of granular *débris*, indistinct nuclei, and the remains of cells. The sub-epithelial layer of the mucous membrane in the neighborhood of the nodules is densely infiltrated with lymphoid cells, the latter being clustered for the most part around the blood-vessels. The edges of the ulcers show an infiltration of round cells or of elements which in their form resemble endothelial cells, while the base of the ulcers is covered with a thick layer of finely granulated *detritus* (cheesy mass). Under this proliferating connective tissue endothelial cells are met with. The mucous follicles are seen undergoing two kinds of de-

generation. In the one the lymphoid or endothelial elements invade the interacinous structure, encroach upon the acini, and ultimately destroy the entire gland, which, while retaining its shape, is transformed into a mass of cells; in the other the gland-cells are not merely pushed aside, but appear themselves to participate in the morbid process. The subepithelial layer of the mucous membrane, not only in the immediate vicinity of the ulcers, but also at some distance from them, shows round-celled infiltration.

Prognosis.—It is doubtful whether the disease can be eradicated when once deposit of tubercular matter has occurred. In Tornwaldt's case the wounds healed very rapidly after the removal of the tumors, but subsequently new granulations appeared.

Treatment.—If there be any troublesome discharge, mildly astringent or disinfectant collunaria should be used; and if tumors of any size cause serious inconvenience by interfering with nasal respiration, they may be removed. Should much pain be felt—which, however, is seldom the case—insufflations of morphia and bismuth would probably give relief.

LUPUS OF THE PITUITARY MEMBRANE.

Latin Eq.—Lupus membranæ pituitariæ.
French Eq.—Lupus de la membrane pituitaire.
German Eq.—Lupus der Membrana pituitaria.
Italian Eq.—Lupus della membrana pituitaria.

Definition.—A deposit of "granulation tissue," occurring primarily in the mucous membrane of the nasal fossæ, which slowly ulcerates.

History.—A few cases of this rare complaint are found scattered through medical records, examples of the disease having been reported by Cazenave [1] and others. The disease was fully described by Hebra and Kaposi [2] in their systematic work on cutaneous affections, and afterward by Moinel [3] in a short monograph.

Etiology.—The causes producing lupus are quite unknown, but it generally occurs in young persons of strumous constitution, and the female sex is more liable to it than the male.

Symptoms.—Lupus, as is well known, generally first attacks the skin of the nose, but cases are occasionally met with in which the disease commences in the nasal mucous membrane, and sometimes it remains confined to that tissue. The malady may appear as lupus *exedens* or *non exedens*. The former variety usually begins on the cartilaginous septum, where small red excessively irritable tubercles are seen at an early period. In the next stage ulcers appear, which have a great tendency to spread, often eating away in their course the whole of the cartilaginous septum, the alar cartilages, and sometimes even portions of the bones themselves. These ulcers are always covered with crusts, under which the process of destruction goes on in one part, while healing may be taking place in another. At the same time there is a foul discharge from the nose, which, though at first re-

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[1] Mém. sur le Coryza chronique, 1848.
[2] Diseases of the Skin, Syd. Soc. Transl., London, 1875, vol. iv., pp. 65–68.
[3] Essai sur le Lupus scrofuleux des Fosses nasales. Paris, 1877.

sembling that of common coryza, later on often assumes the character of virulent ozæna. In lupus non exedens there is no ulceration, but atrophic degeneration and shrinking of all the tissues affected, including the bones and cartilages, occur. A disagreeable odor is exhaled, as in the ulcerative form of the complaint.

Diagnosis.—Lupus is easy of recognition by a practitioner who has previously seen examples of the disease; the youth of the patient, the slowly destructive process, and the crusted ulcers showing a disposition to heal at certain parts, being eminently characteristic. The malady may be mistaken for a syphilitic affection, from which, however, it can generally be distinguished by the curative action of iodide of potassium in the latter disease; it must not be forgotten, however, that syphilis and lupus may coexist in the same patient. It is often extremely difficult, and sometimes impossible, to differentiate lupus in its early stage from epithelioma, but after a time the characteristic features of each affection become manifest.

Pathology.—The microscopic characters of lupus are, briefly, infiltration of the integument with small cells arranged in "nests," at first separate from each other, and at a later stage becoming confluent, so as to involve a considerable area; large numbers of cells are also heaped around the blood-vessels. Fatty degeneration of the cells next occurs and ulceration is produced. Micrococci have recently been discovered in parts affected with lupus by Max Schüller,[1] and it has been shown by him that the offshoots of the micrococci spread into the neighboring connective tissue, the extremities of their root-like processes being covered with granules. These organisms are found in the walls of the small vessels surrounded by round and epithelioid cells.

Prognosis.—Lupus can sometimes be subdued by a well-directed course of treatment, but there is always a great tendency to relapse, and this is especially to be dreaded when the cicatrix remains indurated, and is of a red color or covered with arborescent vessels. In some cases the disease shows a tendency to pass backward and involve the pharynx, and this must be regarded as an unfavorable feature. As the patient gets older, the disease in many instances shows a tendency to spontaneous cure.

Treatment.—The local measures to be adopted in cases where lupus attacks the inside of the nose, leaving the integuments unscathed, consist in destroying the diseased tissues by means of powerful caustics, such as nitric acid, caustic potash, or chloride of zinc, or by the use of galvanocautery. All crusts should be cleared away before employing the caustic, the application of which generally has to be repeated several times. Care must be taken to destroy every portion of the affected part, as any place left uncauterized forms a starting-point for a fresh outbreak of the disease. Constitutional treatment is also of the greatest importance in lupus. Cod-liver oil and tonics, especially iron, are often useful. Hunt[2] maintained that arsenic is a specific in this complaint, and other practitioners have found this drug of service.

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[1] Centralblatt für Chirurgie, 1881, No. xlvi.
[2] Brit. Med. Journ., 1862, vol. i., p. 8.

RHINOSCLEROMA.

This exceedingly rare disease was first described by Hebra[1] in 1870, and examples of it have since been published by Geber,[2] Tantuzzi,[3] Mikulicz,[4] Weinlechner,[5] Billroth,[6] and Cornil.[7] The subject has been fully treated by Kaposi,[8] Neumann,[9] and Pellizzari.[10]

Nothing is known as to the *causation* of the malady, neither sex, constitutional disease, nor personal habits appearing to have any definite influence in producing it. Most of the cases on record have occurred between the ages of fifteen and forty-five. The climate or conditions of life in the south-east of Europe would appear to predispose in some measure to the complaint, since of a total of about forty cases hitherto observed, all but three were met with in Vienna or its neighborhood. Two of these occurred in Italy and one in France, but I am not aware of a single instance in which the disease has been noticed in any other country. Cases of "rhinoscleroma" are mentioned by Spillman[11] as having been seen by Verneuil and others, but from the description of the complaint it was evidently merely perichondritis of the septum.

Rhinoscleroma shows itself generally at the edges of the nostril and on the neighboring part of the upper lip, in the form of flat, slightly raised patches which are smooth on the surface, and of ivory-like hardness. The integument over them is natural, or sometimes dusky red in hue, but round the patches it is neither thickened nor discolored. The swellings are tender on pressure, but otherwise the disease is unattended with pain. The patches may be discrete or confluent, and the disease spreads by gradual infiltration of the surrounding tissues. There is seldom any sign of ulceration, and the growth does not take on increased activity when interfered with. Although the disorder may appear in two or more places simultaneously, or successively, it shows no tendency to generalize itself, either by the blood-vessels or the lymphatics, and there is never any sign of constitutional infection. Its course is very slow, and the patient experiences nothing beyond purely local symptoms. The swelling may involve the septum and the alæ of the nose, so as to make that feature feel as if it were "made of plaster of Paris," and it may invade the upper lip, spreading afterward to the gums and the alveoli. The morbid process occasionally extends back through the nose to the throat as far as the larynx and trachea, or through the mouth to the velum. In each case certain symptoms will be manifested, such as obstruction of the nose, aphonia, or stenosis of the glottis. Rhinoscleroma has to be *distinguished* from syphilis, epithelial cancer, and keloid. It differs from venereal disease mainly in its very chronic course, the absence of softening or ulceration, and its absolute intractability under every kind of medication. From epithelioma, again, it can be discriminated by its smooth glistening sur-

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[1] Wien. med. Wochenschr, January, 1870.
[2] Archiv. f. Dermatol. u. Syph., 4 Heft, 1872.
[3] Il Morgagni, 1872.
[4] Langenbeck's Archiv., Bd. xx.
[5] Quoted by Neumann, op. infra cit., p. 567.
[6] Quoted by Kaposi, op. infra cit., p. 635.
[7] Progrès Médical, July 28, 1883, p. 587.
[8] Pathologie u. Therapie der Hautkrankheiten, Zweite Auflage, Wien u. Leipzig, 1883, Zweite Hälfte, pp. 632-637.
[9] Lehrbuch der Hautkrankheiten, Fünfte Auflage, Wien, 1880, pp. 566-569.
[10] Il Rinoscleroma. Firenze, 1883.
[11] Dict. Encyclop. des Sci. Médicales, art., Nez, t. xiii., pp. 45, 46.

face, its hardness, the absence of bleeding or ulceration, and its persistently *local* character. The history and progress of the case can alone differentiate rhinoscleroma from keloid in many instances.

The *prognosis* is most unfavorable as regards cure, recurrence of the growth taking place after complete removal. The disease, however, does not tend to shorten life, unless it spreads down to the larynx.

Pathologically, the growth is allied to round-celled sarcoma, the essential feature of rhinoscleroma, according to Kaposi,[1] being infiltration of the corium and papillæ with small cells.

This observation is confirmed by Cornil, who, moreover, states that, scattered about among the vessels, there are large spheroidal cells containing one or more nuclei. These are imbedded in a reticular protoplasm, and in this there are also small refracting hyaline bodies, which finally, in the course of development of the cell, fill its whole cavity. These hyaline bodies in some cases pass out of the body of their parent cell into the surrounding tissue. They are not of amyloid or fatty nature, and, according to Cornil, do not contain micrococci. They constitute the distinctive pathological product of rhinoscleroma. True cartilage was found in one instance by Kaposi,[2] and in Chiari's[3] case there was not merely cartilage but commencing ossification.

Medical *treatment* has no effect on the disease, and surgery can do nothing but palliate the more troublesome symptoms. The knife and various caustic agents have been freely employed without success, for, as already remarked, the most complete removal or destruction of the morbid formation has always been followed by recurrence of the disease. Temporary good can, however, often be done. If the nose becomes blocked up, the obstructing growth should be removed or destroyed with the cautery, and the narrowed passage dilated by means of laminaria tents. In threatened suffocation from invasion of the larynx, tracheotomy must of course be performed without delay.

GLANDERS.

Latin Eq.—Equinia ; Malleus humidus.
French Eq.—Morve.
German Eq.—Rotz.
Italian Eq.—Ciamorro.

Definition.—A contagious disease generated by the introduction into the system of a specific poison derived directly or indirectly from a horse suffering from the same affection ; characterized by the formation of pustules, followed by spreading ulceration of the skin in various parts of the body (farcy) and of the mucous membrane of the nose and throat, from which a viscid, muco-purulent or sanious secretion is discharged in great abundance ; accompanied by the usual constitutional symptoms of blood-poisoning, and ending generally in death.

History.—The earliest actual observation of the occurrence of glanders in man was made in 1783 by Osiander,[4] while it was not till 1812 that farcy was described by

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[1] Op. cit., p. 635. [2] Op. cit., p. 635. [3] Ibid.
[4] Ausführliche Abhandlung über die Kuhpocken, 1801.

Lorin,[1] as affecting the human subject. The first detailed account of the whole malady was published by Schilling[2] in 1821. Five years later, three instances of the disease were recorded by Travers,[3] who, however, does not appear to have understood the true nature of the phenomena which he observed. A fatal case of glanders in man was related by Brown[4] in 1829. In the two or three following years the affection was investigated by Elliotson,[5] who, in a series of papers constituting a short monograph on the subject, described several cases which he had himself met with, in addition to a few which he had been able to collect from other sources. Shortly afterward two examples of glanders and farcy in the human subject were published by Graves,[6] who claims to have been the first to call attention to the occurrence of "button-farcy" in man.[7] In 1837 appeared the elaborate report of Rayer,[8] which had a great effect in inducing the establishment of strict sanitary regulations as to infected horses. In 1843 Tardieu[9] published his well-known essay on glanders and farcy. In more recent times, considerable attention was given to the subject by Virchow,[10] and an excellent account of the disease was published by the brothers Gamgee[11] in 1866; since then elaborate articles dealing with human glanders and farcy in the fullest manner have been published by Bollinger[12] and Brouardel.[13] Quite recently the pathology of the disease has been carefully investigated by Bendall[14] and Boyd,[15] while bacilli have been discovered almost simultaneously by several French and German observers (see Pathology).

Etiology.—There can be no controversy as to the cause of this rare disease in the human subject, although there may be some difference of opinion as to the conditions necessary for its production. The complaint, as it affects the *horse*, is seen under two forms, viz., farcy and glanders. The former is characterized by inflammation along the course of the lymphatic vessels, leading to painful swelling of the glands, which suppurate, and after a time burst, giving rise to ulcers secreting a virulent discharge. Glanders, on the other hand, shows itself by the deposit of small nodular growths in the nasal fossæ, accompanied by ulceration of the mucous membrane, and by a discharge from one or both nostrils, at first very thin, but quickly becoming thick, viscous, and foul-smelling. Both farcy and glanders appear under the types of acute or chronic ailments; but there is this remarkable feature about each, that while an animal may be suddenly attacked by either disease in its acute form, the chronic malady is never found as a consequence of the acute stage, but on the contrary, very often precedes it. Farcy and glanders frequently coexist, or the one complaint may follow the other. Their identity is further proved by the fact that while the discharge from the nostrils of a glandered horse may produce an attack of farcy in another animal, on the other hand, the inoculation of matter from "farcy-buds" may give rise to glanders.

Both forms of the complaint are met with in *man*, but the affection is

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[1] Journ. de Méd. Chir et Pharm. Milit., Février, 1812.
[2] Rust's Magazin f. d. gesammte Heilkunde, Berlin, 1821, vol. xi., p. 480.
[3] Inquiry concerning Constitutional Irritation, London, 1826, p. 350 et seq.
[4] London Med. Gaz., 1829, vol. iv., p. 134.
[5] Med.-Chir. Trans., London, 1830, vol. xvi., pt. i., p. 171. Ibid., 1833, vol. xviii., pt. i., p. 201. Ibid., vol. xix., p. 237.
[6] London Med. Gaz., vol. xix., p. 939.
[7] Clinical Lectures. Dublin, 1848, second edition, vol. ii., p. 336.
[8] Mém. de l'Acad. de Méd., Paris, 1837, t. vi.
[9] De la Morve et du Farcin chroniques chez l'Homme et les Solipèdes, Thèse de Paris, No. 15, 1843.
[10] Die Krankhaften Geschwülste, Berlin, 1864–65, vol. ii., p. 543 et seq.
[11] Reynolds' System of Medicine, London, 1866, vol. i., p. 693 et seq.
[12] Ziemssen's Cyclopædia of Medicine, English Transl., 1875, vol. iii., p. 348 et seq.
[13] Dict. Encyclop. des Sciences Médicales, Art. Morve, Paris, 1876, 2e série, t. x., p. 166 et seq.
[14] Trans. Path. Soc., 1882, vol. xxxiii., p. 417 et seq.
[15] Ibid., p. 420 et seq.

so uncommon that very few physicians have ever had an opportunity of observing it. Taking into account the vast number of persons whose business or pleasure brings them much in contact with horses, and the comparative frequency of the equine disease, the extremely rare occurrence of glanders or farcy in the human subject seems to show that some special predisposition is necessary for the poison to be effective. As might be expected, the great bulk of sufferers belong to the class of veterinary surgeons, grooms, coachmen, and others whose occupation requires much handling of horses. From a table drawn up by Bollinger [1] it appears that out of 106 cases of glanders, in 41 the patients were ostlers, in 11 coachmen, in 14 landed proprietors owning horses, in 10 veterinary surgeons, in 12 horse-butchers, in 5 soldiers, in 4 surgeons, in 3 gardeners, and in 2 horse-dealers. Of the remaining 4 patients 1 was a policeman, 1 a shepherd, 1 a blacksmith, and 1 a servant at a veterinary-school. Men, being more exposed to infection, are of course much more liable to the disease than women. In 120 cases Bollinger [2] found only 6 females, and these were mostly wives or relatives of men whose employment lay among horses.

The most common mode of transmission of the malady is by inoculation—that is to say, by the actual contact of discharge from the nostrils of a glandered horse, or of pus from a farcy-abscess, with a wound or abrasion in the skin or mucous membrane. In a fatal case which occurred in my practice some years ago, the source of infection was traced to a diseased horse in a hansom cab. The patient, who had only driven a short distance, noticed that the animal sneezed, and he was annoyed by some of the secretion coming on his face. The infection may be carried by rags used to clean out the nasal fossæ of a diseased animal, or by anything on which the discharges have fallen. One case [3] is on record of the complaint having been communicated by biting, the poison having presumably been carried in the saliva. The disease may be transmitted in its worst form from man to man. There is some doubt whether the poison can be conveyed into the system through the stomach, Decroix's [4] foolhardy and disgusting experiments having yielded negative results.

Symptoms.—Although, as already stated, glanders and farcy are merely different expressions of the same morbid condition, it does not fall within the scope of this work to deal in detail with the latter complaint. As a matter of fact, moreover, the lymphatic system is much less often directly attacked by the poison in man than in the horse.

Glanders, as already remarked, may be either chronic or acute, and it will be convenient to consider the former type of the complaint first, as in the natural evolution of the disease it often precedes the latter. There is usually but little swelling or redness to be seen in the nasal fossæ, and often no discharge, but the mucous membrane is covered with dirty scabs, and ulcerated in several places. The mouth and throat are also affected, although not often to any great degree. The breaking down of the nodules, however, may give rise to ulceration of the tongue, back of the throat, and larynx, and huskiness of voice, slight cough, and even some trouble in breathing may ensue. The expectoration is occasionally bloodstained. The complaint runs a very chronic course, lasting, as a rule, from four to

[1] Ziemssen's Cyclopædia of Medicine, English Transl., 1875, vol. iii., p. 352.
[2] Op. cit., p. 352.
[3] Landouzy: Gaz. Méd., 1844, p. 460.
[4] Bull. de la Soc. Cent. de Méd. Vét., 1870–71. This ardent seeker after truth devoured the flesh of diseased horses, both raw and cooked in various ways, and no unpleasant consequences appear to have ensued.

eight months, but often much longer. Bollinger [1] relates a case in which traces of the disorder, such as cough, dyspnœa, and great prostration, remained after eleven years of suffering. The proportion of recoveries is stated by the same author to be about fifty per cent., but a considerable number of those that are said to be cured are never restored to perfect health. Of the cases that end fatally, in some, death is caused by the exhaustion of the slow fever, with its accompanying night-sweats and diarrhœa, and the septic effect of prolonged suppuration, while in the remainder the malady suddenly takes on the acute character.

The acute form of the disease is almost always fatal, whether it follows chronic glanders or farcy, or comes on as the immediate result of inoculation. Its onset is marked by shivering, sudden rise of temperature, and the usual symptoms of high fever; an erysipelatous rash shows itself on the face, beginning, in most cases, in the nose, but soon spreading over the cheeks and forehead. The surface of the inflamed skin becomes covered with vesicles, which by-and-by burst, and discharge a thin serous fluid, while patches of the integument may even show signs of imminent gangrene. The characteristic glander-pustules appear in crops on the face, intermingled with blebs. The secretion from the pustules soon dries up, and forms a scab, and when this separates, an ulcerated surface remains, which tends to spread on all sides, often with almost phagedænic rapidity. The patient at the same time is afflicted with a painful sense of obstruction in his throat and nasal passages. This is due to the mucous membrane of those parts being thickly studded with pustules. A glairy liquid constantly flows from the nose, and is hawked up from the throat, and there is often a similar secretion from the eyes. As the disease progresses the discharge becomes thicker and more glutinous; it is often streaked with blood, and always very fetid. Occasionally there are sickness, diarrhœa, and abdominal pains. It should be borne in mind, however, that the discharge may be very scanty or, indeed, altogether wanting. When the disease is fully established the voice grows hoarse or may be entirely lost, while difficulty of swallowing is induced by swelling of the epiglottis. The expectoration generally becomes more abundant and more bloody as the disorder pursues its course in the larynx. Paroxysms of dyspnœa ensue from the partial obstruction of the glottis, and the patient gets delirious or falls into the so-called "typhoid" condition, which gradually passes into coma and death. The acute stage of glanders following the chronic form is much more speedily fatal than when it occurs independently, for while in the latter case the disease may last for twenty days or more, in the former death usually puts an end to the patient's sufferings in less than a week.

Diagnosis.—This malady probably sometimes escapes recognition, for unless there be a clear history of inoculation, the practitioner is not likely to think of so rare a disease as glanders. In all instances, therefore, of nasal obstruction and discharge, especially if accompanied by marked derangement of the system, pains in the limbs, and abscesses in various parts of the body, the history of the patient should be carefully inquired into, particularly as regards his occupation and habits. It is only from a broad view of the circumstances that a correct opinion can be arrived at in cases that are at all doubtful. The pustules and ulcers have nothing absolutely distinctive in themselves, and the general symptoms of both glanders and farcy bear a strong resemblance to the salient features of

[1] Op. cit., p. 350.

many other more common affections. Thus the pains about the joints which are met with in farcy are suggestive of rheumatism, until a minute examination reveals that it is not the articulation itself that is complained of, but the muscles and tendons surrounding it. The rigors and abscesses will probably lead the practitioner to suspect pyæmia, especially if there be a history of a dissecting wound; it should be remembered, therefore, that shivering is a much less marked feature in farcy than it is in pyæmia, and that in many instances this symptom is altogether absent. When the complaint is accompanied, as it not unfrequently is, by gastro-intestinal disturbance, it may simulate typhoid fever very closely, but the absence of the rose-colored spots and of the characteristic wave-like rise in temperature will serve to distinguish it from that disorder. Glanders is particularly likely to be mistaken for venereal disease of the nose and throat, but the great amount of constitutional disturbance in the former complaint, and the favorable action of iodide of potassium in the latter, afford ample grounds of distinction. From scrofulous eruptions and ulcers about the face and within the nose the disorder can likewise be distinguished by the severity of the constitutional symptoms which accompany it. With every possible precaution, however, a certain diagnosis cannot always be arrived at, and a striking example of the difficulties surrounding the practitioner who has to deal with this obscure disease is related by Virchow,[1] who records a case in which the autopsy on a patient, whose complaint had not been recognized during life, led to the discovery of a severe epizoötic of the malady among horses which had been previously overlooked.

Pathology.—The disease is of the same pathological type as syphilis and tuberculosis, and it bears a close resemblance to pyæmia. The morbid process exhibits the ordinary sequence of phenomena due to blood-poisoning, viz., infection through broken skin or mucous membrane, inflammation of the lymphatic vessels connected with the point of entrance of the virus, swelling and suppuration of the related lymphatic glands, and gradual generalization of the disease through the entire system. The specific morbid product, if such it can be called, of glanders is a nodule or tubercle, deposited on the skin and mucous membrane in some part of the body, notably on the face, limbs, and walls of the nasal passages. These nodules are usually not much larger than a grain of hemp-seed, and they may be scattered about, or grouped together in clusters. They are at first almost colorless, but rapidly increasing in size, they become first red, and then gradually yellowish in hue, and acquire all the characters of pustules. On microscopic section these bodies are found to consist of pus cells and numerous small nuclei densely packed together; and, quite recently, rod-shaped bacteria, somewhat resembling tubercle-bacilli, have been detected in the pustules and ulcers of men and animals suffering from glanders, by Schütz and Löffler[2] in Germany, and almost at the same time by Bouchard,[3] Capitan,[4] and Charous[5] in France. The nodules show a marked tendency to break down and become converted into small abscesses. These in many cases burst, and a foul sore with irregular edges is produced, which has little or no disposition to heal, and in the acute form of the malady may even spread to the neighboring parts of the skin, or penetrating deeply through the underlying tissues, may reach the skeleton.

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[1] Die Krankhaften Geschwülste, Berlin, 1864–65, vol. ii., p. 554.
[2] Deutsche med. Wochenschr., 1882, No. 52.
[3] Revue Méd. Française, December 30, 1882. [4] Ibid. [5] Ibid.

Prognosis.—Acute glanders is almost invariably fatal, but a few cases of recovery have been recorded.[1] In the chronic disease the prospects of the patient are less gloomy as regards the immediate issue, but the malady leaves ineffaceable marks of its presence, and complete restoration to health can hardly ever be looked for. As to the disease in general, perhaps the best practical guide for the physician in forecasting the result of a case is to be found in the rule laid down by Brouardel,[2] that so long as the *nose* is not affected there is still room for hope.

Treatment.—The treatment of glanders, when once the system has been impregnated with the poison, is confessed by all writers on the subject to be almost utterly ineffectual. Certain general principles must, of course, be adhered to, such as carefully attending to all the symptoms as they are developed, and watching the constitutional condition of the patient, so as to give stimulants when the strength begins to flag, anodynes or sedatives if there be pain, excitement, or sleeplessness. Emetics and purgatives have been recommended, but the former should never be given, and the latter only when clearly indicated. Various preparations of iodine and sulphur have been at different times proposed as specific remedies, and recoveries have been attributed to the use of each of those drugs.[3]

Certain local remedies should not be neglected, as, even if they fail to prolong the patient's life, they may lessen his suffering, and, what is also of importance, diminish the risk of this loathsome disease being conveyed to his attendants. Elliotson[4] states that he succeeded in stopping the discharge from the nose by injecting a solution of two grains of creasote in a pint of water three times a day. Ulcerated surfaces should be frequently dressed with lint steeped in carbolic acid solution (1 in 60 or 80).

It need hardly be added that the most vigorous prophylactic measures should be carried out wherever the disease is found to exist. In the case of horses this is enforced by legal enactment, and though the malady is less likely to be communicated by man to man, the utmost care should always be taken to destroy or disinfect anything by which the virus may be conveyed. According to the experiments of Gerlach,[5] carbolic acid destroys the activity of the poison, and any one who is in attendance on a case of glanders, whether in man or beast, should on no account neglect to wash his hands and instruments in a strong solution of this antiseptic agent after every dressing.

An interesting observation has lately been published by Meyrick[6] which tends to show that (as might be expected) the virus becomes attenuated by long exposure to the air, and that animals inoculated with this milder poison suffer from a modified form of the disease. A cavalry party was picketed on a sandy plain in the neighborhood of Cairo, *near* to a spot which had been occupied some months before by a detachment of Indian cavalry, whose horses had suffered severely from glanders. Two horses belonging to the former contracted glanders, and several others had swelling of the submaxillary glands and vesicles on the Schneiderian membrane, which burst, but healed quickly without ulceration. The important question to be decided now is whether the inoculation of virus, weakened by proper cultivation, would act as a preservative against the effect of glan-

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[1] Brouardel, op. cit., p. 184; Harrison, Lancet, vol. ii., 1872, p. 910; Haynes Walton, Med. Times and Gaz., 1877, vol. ii., p. 13.

[2] Op. cit., p. 191. [3] See Brouardel: op. cit., p. 202. [4] Loc. cit.

[5] Quoted by Bollinger, op. cit., p. 370.

[6] Veterinary Journal, 1883, vol. xvii., p. 179.

ders-poison in its more active form. On this point there is not yet, so far as I am aware, any evidence whatever.

AFFECTIONS OF THE NOSE IN ERUPTIVE FEVERS, AND OTHER ACUTE DISEASES.

Measles.—In measles, serous flux from the nose, with congestion of the conjunctiva, is one of the earliest symptoms. Occasionally this is followed by severe rhinitis, and in these cases epistaxis not unfrequently occurs. If these acute symptoms subside, and the patient recovers, dry catarrh and ozœna sometimes remain behind. Ulceration of the septum has also been observed.[1]

Scarlet Fever.—In *scarlatina anginosa* the nasal mucous membrane is often involved. The affection may be of merely catarrhal character, or, on the other hand, the inflammation may be very severe, and accompanied by great swelling of the mucous membrane and an abundant irritating discharge. Ulceration sometimes takes place, and this may be followed by epistaxis.

Small-pox.—In this disease, especially in the confluent variety, pustules occasionally form inside the nose, causing obstruction of the passage, and in certain cases producing epistaxis. Complete obliteration of one or both nostrils has more than once resulted from the union of the opposite raw surfaces of the outer and inner walls of the nostril when the scabs have come away. An instance of this kind has been recorded by Luc,[2] who succeeded in remedying the condition by incising the nostril and afterward keeping it open by dilatation.

Typhoid Fever.—In all adynamic fevers it is well known that there is a tendency to acute inflammation of tissue, with formation of abscesses. The influence of position, which in typhoid fever is so largely concerned in the production of throat affections, does not come into operation in the case of the nose, but changes are apt to occur in the mucous membrane from the drying of masses of mucus within the nasal fossæ. The ulcers thus formed often spread, and necrosis of the septum may take place, resulting finally in perforation. Cases due to long and exhausting fever have been observed by Roger,[3] Lecœur,[4] Gietl,[5] Lagneau,[6] and Charcot.[7]

Rheumatism.—In rheumatic fever, severe inflammation and ulceration of the pituitary membrane sometimes occur, and even necrosis of the cartilaginous portion of the septum has been noticed. An instance of this kind has been related by Roger,[8] in which a young man suffering from very severe rheumatism, with well-marked cardiac complications, lost a portion of his septal cartilage of about the size of a grain of rice two months before his death. A somewhat similar case has also been reported by Corbel.[9]

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[1] Joffroy: Bull. de la Soc. Anat., 1870, p. 164. Also Dechant: De la Rougeole, Thèse de Paris, 1842, p. 24.

[2] Quoted by Casabianca: Des Affections de la Cloison des Fosses nasales, Paris, 1876, p. 17.

[3] Gazette des Hôpitaux, 1860, p. 153.

[4] Ibid., p. 214.

[5] Union Médicale, 1862, t. xvi., p. 523.

[6] Gazette Hebdom., 1863, p. 440.

[7] Quoted by Casabianca, op. cit., p. 33.

[8] Union Médicale, 1860, nouvelle série, t. v., p. 468.

[9] Gazette des Hôpitaux, 1860, p. 178.

Influenza.—It has not appeared to me desirable to treat influenza in a separate article, as the symptoms affecting the bronchial tubes and the lungs are so much more important than those which manifest themselves in the nose. It must not be forgotten, however, that the latter are the first to attract attention.

Nasal Diphtheria.—This affection has already been fully considered (vol. i., p. 136).

FRACTURES OF THE NOSE.

Latin Eq.—Fractura ossium nasi.
French Eq.—Fracture des os du nez.
German Eq.—Fractur der Nasenknochen.
Italian Eq.—Frattura delle ossa del naso.

Definition.—Fractures of the bones or cartilages of the nose, often compound, either from a wound in the skin, or from laceration of the mucous membrane, generally accompanied by considerable contusion and some displacement.

History.—Fracture of the nasal bones has been familiar to practitioners from the earliest times of surgery. Hippocrates[1] discusses such injuries at some length, and the methods of treatment which he recommends shows that he must have had a large experience of broken noses; and when it is remembered that he practised among a people who held boxing in high esteem, this is hardly to be wondered at. Hippocrates mentions that fractures of the nose were done up in such an elaborate way that every young surgeon was anxious to meet with an example of the injury, in order that he might have an opportunity of showing his skill in bandaging. It may be remarked in connection with this subject that Hippocrates recommends the application of shreds of linen steeped in white of egg as the best means of keeping the bones in place—a remarkable anticipation of the starch bandage of modern days. In the sixteenth century Ambrose Paré[2] strictly followed Hippocrates in his mode of treatment. In modern times, Jarjavay[3] has written at some length on certain sequelæ of fracture of the nose; and William Adams[4] has published some important improvements in the mode of treating the injury, especially as regards the avoidance of subsequent deformity.

Etiology.—Owing to the arched form of the nasal bones, and their sheltered position between the prominence of the *os frontis* and the cartilaginous tip of the nose, they are seldom broken, except when a person falls against a sharp corner, such as the edge of a step or a table, or the angle of a wall, or when an angular body, such as the knuckles of a man's fist, or the iron shoe of a horse, is driven violently against the nose. The nasal bones are, however, liable to be fractured by blows which fall on them sideways. In such cases both bones are usually broken transversely, the lower fragments being dislocated toward the opposite side to that on which the blow is received. Falls on the head sometimes produce fractures of the roof of the nose, *i.e.*, of the ethmoid bone, but in these cases the injury of the base of the skull is, of course, very much more important than that of the nose. On the other hand, it has been found experi-

[1] De Artubus, Paris, 1884, Littré's edition, vol. iv., p. 159.
[2] Œuvres, livr. 8, ch. xxvi., Paris, 1840, Malgaigne's edition, vol. ii., p. 86.
[3] Bull. Général de Thérap., 1867, t. lxii., p. 539 et seq.
[4] Brit. Med. Journ., 1875, vol. ii., pp. 421, 422.

mentally by Hamilton,[1] that direct injury to the septum will not cause fracture of the cribriform plate. The nose would, however, be much more liable to fracture were it not for the yielding character of the cartilage, on which blows mostly fall, breaking the shock in great measure. Gurlt[2] found that out of a total of 225 fractures of the bones of the head, there were 22 of the nose, 17 of the upper jaw and zygoma, and 56 of the lower jaw; while Otto Weber,[3] in 56 fractures of the cranial bones, met with 10 of the nose, 4 of the upper jaw and zygoma, and 9 of the lower jaw.

It is possible that the delicate skeleton of an infant's nose may be irretrievably damaged by the blades of the forceps in childbirth, but I am not aware of any actually recorded case of this accident, except the somewhat questionable one of Tristram Shandy. Fibrous and malignant tumors of the nasal fossæ or the neighboring parts sometimes produce fracture of the bony roof or parietes of the nose, but more often the pressure of such growths causes absorption of the bone.

Symptoms.—The injury varies from a simple fracture without displacement to complete crushing of the nasal arch. A case has come under my notice in which the wheel of a tramcar passed over the face of a gentleman, completely crushing his nose, but doing him very little damage otherwise. The disfigurement, however, was so great that the patient had to retire from his profession. In another instance with which I am acquainted the bony part of the nose was crushed flat by a fall, leaving an ugly knob corresponding to what had been the tip of a very shapely feature, and giving the whole face a markedly simian expression. The sufferer, a highly popular abbé, had to hide his disfigurement in a monastery. Even in the slighter forms of injury there is ordinarily great swelling of the soft parts, with widespread ecchymosis and œdema of the eyelids and cheeks. There is always some epistaxis,[4] and occasionally, when the mucous membrane has been torn, emphysema occurs. This usually follows the accident on violent sneezing or blowing of the nose, and, although very alarming to the patient, is of no importance. In order to make a satisfactory examination, the patient should be fully anæsthetized, when the nature of the injury will, as a rule, be ascertained, although it is in most cases difficult to detect crepitus. By passing a small probe up the nose with one hand, while with the other the parts are gently manipulated externally, any displacement will generally be discovered. Hamilton[5] judiciously points out that a *small probe* is much more useful than a catheter, which is usually recommended, and which, from its size, often cannot be passed, even when force is used. The sense of smell is frequently impaired, and sometimes even destroyed, from injury to the terminal twigs of the olfactory nerves.

Diagnosis.—If the directions already given be followed (see Symptoms), the nature of the accident will in most cases be recognized without much difficulty.

Pathology.—The only special point that need be referred to in connec-

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[1] Practical Treatise on Fractures and Dislocations, Philadelphia, 1866, third edition, p. 93.

[2] Handbuch der Lehre von den Knochenbrüchen, Hanover, 1864, vol. ii., p. 499.

[3] Op. cit., p. 179.

[4] One fatal case of hemorrhage was observed by Rossi. Quoted by O. Weber in v. Pitha und Billroth's Handbuch der Chirurgie, Bd. iii., 1. Abtheil., 2. Heft., Erlangen, 1866, p. 181. Another was recorded by West (Lancet, 1862, vol. i., p. 660). Bleeding recurred again and again, and the patient, a man aged sixty, died exhausted on the twenty-third day after the injury.

[5] Op. cit.

tion with the pathology is the remarkable disposition to rapid union in fracture of the bones of the nose. This peculiarity attracted the attention of Hippocrates,[1] and it is now recognized as being due to the extraordinary plastic power of the bones in the upper part of the face, a property which has been taken advantage of in the "osteoplastic operations" of Langenbeck, Ollier, and others, hereafter detailed.

Prognosis.—The greatest disfigurement may always be anticipated if the accident be not properly treated, and this may have the most serious results as regards the patient's future career. It must not be forgotten that such injuries may also be attended with danger to life. Gurlt[2] has shown that in cases in which at the time of the accident there was no evidence of injury to the brain, cerebral symptoms have afterward come on. Out of fourteen examples of fracture of the nose collected by Weber[3] in the Bonn Clinic, there where four in which there was concussion of the brain, one of them terminating fatally.

Treatment.—The rapid union which takes place after fractures of the nose just referred to, though a highly conservative process, makes it of the utmost importance that the condition should be discovered in time to avoid deformity from improper union. As the tissues covering the broken bones are usually much contused, the first thing to be done is to attempt to disperse the swelling by means of evaporating lotions or other cold applications. The fragments should then be, as far as possible, replaced. This can generally be done by means of a pair of fine dressing-forceps or a female catheter introduced within the nose, combined with manipulation with the fingers of the left hand on the outside. Once restored to their proper position the fragments show little tendency to separate, for, as pointed out by Holmes Coote,[4] they are not acted on by any muscles. There is seldom, therefore, any necessity for splints or other supporting apparatus, which are, moreover, as a rule, intolerably irksome to the patient. If, however, the *septum* has been fractured, and displacement has been produced, Adams[5] advises that the fragments should be forcibly restored to their proper position with forceps, and retained *in situ* by means of a special splint and truss (p. 196). Jurasz' ingenious modification of Adams' instrument (see p. 196), which combines both forceps and splints, may also be advantageously used for the same purpose. Mason[6] has recently described a new method of treating fractures of the nose where the nasal processes of the superior maxillary bone are involved, and where, consequently, there is marked depression of the fragments. After reduction a needle is passed through the skin *behind* the fragment and brought out through the skin on the other side of the nose. A narrow band of india-rubber is fastened over each end of the needle, so as to make gentle pressure on the sides of the nose. This makes a firm support for the broken piece, preventing it from becoming depressed. Evaporating lotions or other dressings can be easily applied without disturbing the apparatus. The needles are to be removed from the sixth to the tenth day. Mason says that the wounds produced by the needle are quite insignificant. The plan appears to have been tried in only one case as yet, but the result was very encouraging.

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[1] Op. cit., p. 167. [2] Op. cit., p. 240.

[3] V. Pitha und Billroth's Handbuch der Chirurgie, Bd. iii., 1. Abtheil., 2. Heft., Erlangen, 1866, p. 181.

[4] Holmes' System of Surgery, second edition, 1870, vol. ii., p. 427. [5] Loc. cit.

[6] Annals Anat. and Surg. Soc., Brooklyn, N. Y., 1880, vol. ii., p. 107 et seq., and pp. 197–199.

DISLOCATION OF THE NASAL BONES.

Separation of the nasal bones from the frontal bone, or from the nasal process of the superior maxillary, is so rare that its occurrence has been denied. Benjamin Bell[1] states that "instances of it are sometimes met with," but without furnishing any details. Malgaigne,[2] however, gives the particulars of a case in which the existence of luxation of the nasal bones was established as certainly as any form of injury can be made out by touch and appearance without actual dissection. A man in falling struck the left side of his nose with great violence against the edge of the pavement. On examination, shortly after the accident, the upper third of the nose was seen to be deflected toward the right side, the lower part preserving its normal direction. The lower edge of the right nasal bone projected over its corresponding cartilage, while on the left side the inner edge of the nasal process of the superior maxillary stood out in sharp relief from the depression of the left nasal bone, a gap being evident between the upper edge of this latter and the frontal bone. There was no fracture. It is evident from this description that while on the right side the nasal bone was only separated along its lower edge, there was complete luxation of the corresponding bone on the left side, where the blow had been received.

In a case recorded by Longuet,[3] in which a soldier received a very heavy blow near the inner angle of the right eye, the upper part of the nasal bones appeared to have been pushed over bodily toward the left side, the septal cartilage, however, remaining in its normal position. The edge of the nasal bone could be plainly felt overriding the nasal process of the upper jaw on one side, while on the other the corresponding edges were visibly separated by a groove wide enough to admit the thumb-nail.

It will be observed that the mode of production of the injury is almost identical in these two cases, viz., a violent blow striking the nose sideways. It was only in this manner, also, that Longuet was able to produce luxation of the nasal bones in several experiments which he made on the dead body. The nasal bones may also be pushed asunder by a fibrous or sarcomatous mass, giving rise to the unsightly "frog-face" hereafter described. (See Fibrous Polypi of the Naso-Pharynx.) The *symptoms* in the two cases related above were very much alike, consisting in epistaxis, swelling, tenderness, and a characteristic deformity. *Reduction*, which in Longuet's case was exceedingly difficult, and only partially successful, is best accomplished by combined manipulation of the displaced bones from the interior of the nose and the outside. As the pain of the operation is very great, it is desirable to anæsthetize the patient before the reduction is commenced.

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[1] System of Surgery, Edinburgh, 1788, vol. vi., p. 184.

[2] Revue Méd.-Chir. de Paris, 1851, t. x., p. 82.

[3] Recueil de Mémoires de Méd., de Chir. et de Phar. Milit., t. xxxvii., 3e fascicule, May–June, 1881, No. 202, p. 284.

DEVIATION OF THE NASAL SEPTUM.

Latin Eq.—Incurvatio septi narium.
French Eq.—Déviation de la cloison du nez.
German Eq.—Verbiegung der Nasenscheidewand.
Italian Eq.—Deviazione del setto nasale.

History.—More than a century ago, a short monograph was published by Quelmalz [1] on curvature of the nasal septum, which he appears to have considered as resulting in nearly all cases from injury or disease. Later on, Morgagni,[2] who claims to have given special attention to this matter, was disposed to attribute the condition to too rapid growth of the septum in proportion to that of the upper jaw. Soon afterward, Haller [3] pointed out the frequent occurrence of this deformity, which he thought rendered the subjects of it more liable to catarrh than other people. The subject was briefly referred to by Hildebrant,[4] and again by Velpeau.[5] In 1851 Chassaignac [6] dealt with deviation of the septum in its cartilaginous portion, and described a method by which he succeeded in correcting the deformity. Another plan of procedure was tried by Blandin,[7] and an operation has been devised by Adams,[8] and improved by Jurasz,[9] for which excellent results are claimed. Theile [10] seems to have been the first who attempted a numerical estimate of the frequency with which asymmetry of the nasal septum is found in the dry skull, a matter which has recently received further illustration at the hands of Semeleder,[11] Sappey,[12] Harrison Allen,[13] and Zuckerkandl,[14] and a highly scientific anatomical work has been recently published on the subject by Welcker.[15] Löwenberg [16] has lately written a suggestive paper on these deviations, and their influence on the condition of the singing voice has been pointed out by Walsham.[17]

Etiology.—An asymmetrical position of the septum is very common. Numerical observations as regards the frequency have at present only been made on dried specimens, in which the cartilage is very seldom present. In 117 skulls Theile found deviation in 73.5 per cent. Semeleder in 49 crania met with it it 79.5 per cent., the septum being bent toward the left side in 20, and toward the right in 15 cases. In 4 instances the curvature was of a sigmoid outline, thus bulging into both nasal fossæ in different places. Allen, in 58, found the septum so much deflected in 68.9 per cent. as to come in contact with the upper and middle spongy bones ; while Zuckerkandl, in 370 skulls, met with an asymmetrical position in 140 cases, *i.e.*, in 37.8 per cent. In 57 cases the bend was to the right, in 51 to the left, and in 32 it was S-shaped. With the view of investigating the whole subject of septal asymmetry on a larger scale, I have lately made a careful examination of the collection of skulls in the Museum of the Royal

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[1] De narium, earumque septi, incurvatione. Lipsiæ, 1750.
[2] De sed. et caus. morb., Lugd. Patav., 1767, epist. xiv., art. 16, vol. i., p. 207.
[3] Elem. physiol. corp. human., Lausannæ, 1769, t. v., p. 138.
[4] Lehrb. d. Anat., Wien, 1802, Bd. iii.
[5] Traité complete d'Anat. Chir., Paris, 1837, 3e éd., t. i., p. 252.
[6] Bull. de la Soc. de Chir., 1851–52, t. ii., p. 253.
[7] Compendium de Chir. Prat., t. iii., p. 33.
[8] Brit. Med. Journ , October 2, 1875.
[9] Berlin. klin. Wochenschr., 1882, No. 4.
[10] Zeitschr. f. rationelle Medicin. Neue Folge, 1855, Bd. vi., p. 242 et seq.
[11] Die Rhinoskopie, Leipzig, 1862, p. 64.
[12] Anatomie descriptive, t. iii., 3e éd., Paris, 1877, p. 674.
[13] Amer. Journ Med. Sci., January, 1880, p. 70.
[14] Anatomie der Nasenhöhle, Wien, 1882, p. 44 et seq.
[15] Asymmetrien der Nase. Stuttgart, 1882.
[16] Arch. of Otology, vol. xii., No. 1, March, 1883.
[17] St. Bartholomew's Hosp. Rep., vol. xviii., p. 11 et seq. See also Lancet, April 12, 1883, p. 705.

College of Surgeons, with the assistance of Mr. C. L. Taylor. The total number of crania actually examined was 3,102, but of these only 2,152 had the bony septum in sufficient preservation to be tested. In each instance of septal asymmetry, the degree of deflection from the middle line of the face was measured as accurately as possible by means of a little instrument [1] which I devised for the purpose. It was found that the average deviation of the septum in the 2,152 skulls was about four millimetres; the greatest degree being nine millimetres, and the least half a millimetre.[2] Among them no fewer than 1,657, or 76.9 per cent., presented a more or less unsymmetrical position of the septum. In 838, or 38.9 per cent. of the cases, the deviation was toward the left side; in 609, or 28.2 per cent., toward the right; in 205, or 9.5 per cent., the deflection was "sigmoid" in character, bulging toward *both* sides at different levels, while in 5, or 0.23 per cent., the irregularity was of a type that may be called "zigzag," *i.e.*, the perpendicular lamina of the ethmoid and the vomer, instead of joining accurately to form a smooth plate of bone, lay in different planes, and overlapped each other at their contiguous edges. It must be remembered that these figures have reference only to the *bony* septum, and that deviations of the cartilaginous part probably occurred in a large proportion of those cases in which the bone itself was straight. Hence the actual percentage of deflections is much higher during life than would appear from the above statistics. According to Zuckerkandl the superior races show a greater disposition to this deformity than those of a lower type, for in 103 non-European crania it was present in only 23.3 per cent. My investigations yield very similar results, for of 438 examples of *symmetrical* septa only 22.6 per cent. were from Europeans,[3] the rest being from Africans, aborigines of the American Continent, natives of the Polynesian Islands, and a few from the Andaman Islands, the New Hebrides, New Guinea, the Solomon Islands, and from the Island of Teneriffe.

The cause of deviation of the bony septum is very obscure. Cloquet [4] somewhat oracularly veils his ignorance of the matter under the high-sounding phrase, that curvature of the septum "depends on a primary law of organization." It was at one time thought that the condition was often of congenital origin, but according to the researches of Zuckerkandl the septum is always straight before the seventh year. It is not impossible that the deflection may result from the fact that ossification of the septum proceeds from centres situated in two different bones, and that these deposits of ossific matter do not subsequently meet in the same plane. As regards deviation of the cartilaginous septum, various causes have been assigned for the anomaly, such as always blowing the nose with the same hand, or habitually sleeping with the same side of the face on the pillow; but the evidence in support of these views is, to say the least, insufficient. Chassaignac [5] suggests that there may be a tendency to overgrowth in the

[1] This consisted of a couple of short metal bars supported on a cross-piece placed at right angles to one of them, the other being midway between the two—that is to say, at an inclination of 45° to each. The angle between the two little bars was subtended by a curved piece of metal constituting an arc which was graduated in millimetres, so that by placing the upright bar in a position corresponding to the middle line of the nose, the degree of obliquity of any object within the nasal cavity could be easily read off on the scale.

[2] Septa showing a deviation of less than half a millimetre were counted as straight.

[3] It is remarkable that nearly half of these were Italian skulls, which as a class were of strikingly symmetrical proportions.

[4] Osphrésiologie, Paris, 1821, 2me éd., p. 165.

[5] Bull. de la Soc. de Chir., 1851–52, t. ii., p. 253.

vertical direction, and this being prevented by the firm bony attachments, the elastic substance of the cartilage necessarily bulges out laterally into one or other nasal fossa.

Symptoms.—When the deflection is considerable, the whole nose is twisted to one side, and the most casual observer notices the disfigurement; but when the deviation of the septum is not great, it may merely cause a slight twist of the tip of the nose, or it may not even give rise to any external alteration. Anterior rhinoscopy, however, makes the condition at once apparent, and though the deformity scarcely ever (never, according to my observations) affects the posterior part of the septum, the rhinal mirror often reflects the deviation in the central and anterior portions of the nose. The tumor frequently encroaches on the corresponding nasal channel, and in some cases completely occludes it. In such instances the distortion of the septum, in addition to its unsightly appearance, gives rise to functional troubles which may occasionally amount to serious inconvenience. Respiration through the nose is interfered with, the voice acquires the characteristic nasal twang, the discharge of the pituitary secretion through the nostril is prevented, and post-nasal catarrh, with its attendant evils, results. The turbinated bodies are not unfrequently so pressed upon that they undergo atrophy, and dry catarrh may then ensue. In a case recently under my care, the most troublesome symptom was epistaxis, caused by erosion of the outer wall of the nose.

Diagnosis.—It is difficult to understand how any error could be made as regards this disease, except by those who do not make a proper rhinoscopic examination, or who are entirely unacquainted with nasal affections. Yet the deformity has frequently been mistaken for thickening and sometimes for polypus.[1] Careful comparison of both sides of the septum at once determines the former point; but an ingenious "septometer" has been invented by Seiler,[2] which serves to distinguish thickening from deviation when these affections occur separately. Polypus can be easily recognized by its comparative softness, elasticity, mobility, and pale color.

Pathology.—The deviation is almost always limited to the anterior three-fourths of the septum.

The bony ridges already described as being common on the lower half of the septum (p. 270) are frequently found associated with curvature of that partition. Thus in 673 specimens, in the Hunterian Museum, in which a ridge existed, the septum was deviated in 588. In 414 instances the ridge was on the side toward which the septum projected, in 107 on the opposite side, and in 85 skulls there was a ridge without any deflection of the partition itself. Although, owing to the difficulty of determining with certainty the sex from the cranium alone, it is not possible for me to give exact figures on the subject, I am inclined to think that these bony ridges are relatively less common in women than in men, and that when they are present in the former they are (as might naturally be expected) both less thick and less prominent. The foregoing woodcut (Fig. 86) gives a very good representation of such a ridge, and of septal asymmetry in general.

Treatment.—When the bony septum is the seat of marked deviation it might sometimes be possible to remedy the condition by fracturing the distorted partition with Adams' forceps (Fig. 72, p. 196), and fixing the fragments in a more symmetrical position by means of his splint intro-

[1] Chassaignac: Loc. cit., p. 256. I have myself also known this mistake to be made in more than one instance.

[2] Disease of the Throat, etc., 1883, second edition, p. 83.

duced into each nostril. I am not aware that this method has ever been used for the rectification of natural deformity, but Adams has had such excellent results [1] from it in the treatment of fracture of the septum that it seems worth trying in cases of non-traumatic deviation. It is only, however, when the deflection is extreme that so severe a procedure would be justifiable.

The treatment of the bony outgrowths sometimes found in connection with a deviated septum has been already discussed (p. 271).

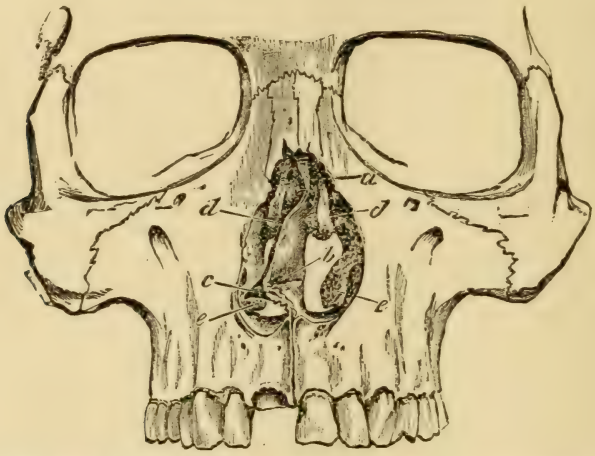

FIG. 86.—Anterior Nares and Part of Skull, showing the Septum deviated according to the Sigmoid Type. *a*, upper part of the septum bent toward the left side; *b*, concavity on left surface corresponding to convex portion bulging into right nasal fossa; *c*, bony crest or ridge projecting into left fossa; *dd*, middle, and *ee*, lower spongy bones. (The amount of deviation here shown is seen in several specimens in the Museum of the Royal College of Surgeons, and bony ridges also occur in many of them. The above cut is a composite drawing of various deformities met with in different skulls.)

When the deviation is in the cartilaginous portion, the simplest plan of treatment is that of Michel,[2] who directs the patient to make gentle pressure on the nose with the finger, toward the opposite side. This must, of course, be done very frequently each day, and it is obvious that it is applicable only in the case of young persons, and where the deformity is comparatively trifling. Where the object of the surgeon has been more to remove a source of disease than to correct a deformity, good results have been obtained by establishing free communication between the unobstructed fossa and its fellow. This was first proposed and accomplished by Blandin,[3] who removed a piece of the cartilage with a kind of punch. Chassaignac [4] relieved a very bad case by dissecting up the mucous membrane, and paring off slices of the protuberant cartilage, thus reducing its bulk and freeing the nasal channel from the greater part of the obstructing mass. Walsham [5] forcibly replaced the bent septum of a patient in whom the deformity had caused loss of the singing-voice, at the same time incising the cartilage in a stellate manner to overcome its resiliency. The voice was completely restored.

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[1] Brit. Med. Journ., October 2, 1875.
[2] Krankheiten der Nasenhöhle, Berlin, 1876, p. 29.
[3] Compendium de Chirurgie Pratique, t. iii., p. 33.
[4] Loc. cit., p. 256.
[5] Loc. cit.

BLOOD-TUMORS OF THE NASAL SEPTUM.

History.—The first clear account of hæmatomata and abscesses of the nasal septum was given by Cloquet in 1830,[1] and three years later the affection was described by Fleming,[2] from his own observations. Examples have since been published by Bèrard,[3] Maisonneuve,[4] Velpeau,[5] and others; and in 1864 Beausennat[6] took these affections as the subject of his inaugural thesis. A brief account of them was given by Casabianca,[7] in a short essay published in 1876. I have myself met with only one case of blood-tumor and one of septal abscess.

Violent blows on the nose, which give rise to fracture of the bony or cartilaginous septum, sometimes *cause* blood-tumors, which collect within a few hours after the accident. The swelling results from the effusion of blood between the deep layer of the mucous membrane and the underlying cartilage, and as this accident seldom occurs without fracture, the collection of blood usually takes place on both sides of the septum, and a bilateral tumor is formed. Two cases of *spontaneous* unilateral hæmatoma of the septum have been recorded. One was related by Luc,[8] in which an Arab boy, aged ten, had complete obliteration of both nostrils, dating apparently from an attack of confluent small-pox, from which he had suffered five years before. On dividing the cicatricial tissue, a blood-cyst was found in one nostril attached to the septum. In the other case, reported by Péan,[9] few details are given, but the tumor, which was connected with the septum, was soft, pale blue in color, and contained blood. Blood-tumors have a smooth surface and are purple in color, the rest of the mucous membrane of the nose, as pointed out by Fleming, being often of a similar ecchymotic hue. They are situated just within the nostrils, and in the only case which I have met with had very much the appearance of cysts. They are easily seen, and their symmetrical character, together with the fluctuation from one side of the septum to the other, which can be perceived when the tumor is examined with a forefinger in each nostril, generally serve to determine its nature. When the swellings are large, they sometimes even protrude from the nostrils. Their soft consistence serves to distinguish them from bony or cartilaginous tumors, and their symmetrical origin by a broad base from each side of the septum differentiates them from polypus. It is difficult, however, to discriminate between these tumors and septal abscesses, into which, if not cured, they soon pass. The patient rarely recovers without a permanent aperture in the septum.

If *treated* sufficiently early, hæmatomata may sometimes be dispersed by the free use of evaporating lotions; but if this plan does not succeed within a day or two, there is every chance of purulent degeneration of the extravasated blood taking place, and of the formation of an abscess. It is better, therefore, to empty the sacs by opening one of them at its most dependent part; and should this not suffice for the complete evacuation of the contents of both tumors, the other one should also be opened. Jarjavay[10] recommends that general antiphlogistic treatment should be combined with these surgical measures, especially at the outset.

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[1] Journ. Hebd. de Méd., No. 91, t. vii., p. 545.
[2] Dublin Journ. of the Med. Sciences, September, 1833, vol. iv., p. 16 et seq.
[3] Archiv. Gén., t. xiii., 2e sér., p. 408.
[4] Gazette des Hôpitaux, 1841, p. 59.
[5] Ibid., 1860, p. 178.
[6] Des Tumeurs sanguines et purulentes de la Cloison, Thèse de Paris.
[7] Des Affections de la Cloison, Paris, 1876, p. 23 et seq.
[8] Bull. de la Soc. de Chir., 1875.
[9] Nélaton: Pathologie Chirurgicale, 2e ed., t. iii., p. 740.
[10] Bull. Gen. de Thérap., 1867, t. lxxii.

CASE OF HÆMATOMA OF THE NOSE.

W. H. E., aged twenty-seven, a farrier, was brought under my notice at the Throat Hospital, in March, 1863, by Dr. Frodsham. The patient stated that in shoeing a horse about ten days previously he had received a slight kick on the nose, but that the hoof had scarcely touched him. Since then, however, he had felt a constant dull aching sensation in the nose, which he said was "completely stuffed up." On examination, both nasal passages were seen to be blocked up by dark, red, round tumors, which appeared rather tense. On making an exploratory puncture into the swelling on the right side, blood slowly oozed from the wound. A large opening was now made at the lowest part of the right tumor, and through it both cysts (for such they appeared to be) were evacuated. The next day, however, they had filled again. An incision, nearly half an inch in length, was next made in the left tumor, but three days later this also closed up. An opening was then made in both tumors, and a small piece of lint inserted in each. This treatment proved successful. Some sanious matter continued to escape from the left swelling for about fourteen days, when the wound healed. A purulent discharge from the right tumor gradually ceased at the end of a month. It was then noticed that there was a semi-circular aperture in the anterior part of the septum, about half the size of a fourpenny-piece, the edges of which were ulcerated. The patient had never noticed any solid matter come away. The rest of the mucous membrane of the septum was rather dry and of a deep red color. With the exception of the opening, the patient ultimately recovered completely.

ABSCESS OF THE NASAL SEPTUM.

(*For History see last Article.*)

These abscesses may be acute or chronic.

The *Acute* septal abscess is mostly of traumatic *origin*, and comes on within a few days, though sometimes not for a week or two, after the injury. It may result directly from the inflammation of the parts, or it may be due to the degeneration of a blood-tumor, as described in the foregoing article. Like the latter, the abscesses are generally situated at the fore part of the septum, and they are almost always symmetrically bilateral. They present the ordinary characters of an inflamed part, and may be accompanied by some slight constitutional disturbance. The nose is obstructed, the voice muffled, the conjunctivæ are red and extremely sensitive to light, while there is frequently profuse lachrymation. There is often also a good deal of redness and tenderness of the skin of the nose itself. *Chronic* abscesses have the same shape and position as those of an acute character, and usually arise from the same causes. They are, however, much less quick in forming, less painful, of a lighter color, and are accompanied by little or no systemic disturbance. They have been mistaken for mucous polypi, but the points of diagnosis already indicated in dealing with hæmatomata are amply sufficient to differentiate these tumors. Like blood-tumors, their cure is generally followed by a permanent opening in the septum. The only effectual *treatment* is to evacuate the contents of the sacs; and free drainage can only be insured by opening both the tumors, and keeping the incision patent with a small linen tent or by the occasional introduction of a probe.

CASE OF CHRONIC SEPTAL ABSCESS.

Charles H., a laborer, aged thirty-one, had been under my care at the London Hospital, for a short time, in the early part of 1870, on account of general weakness after typhoid fever, when at one of my visits he complained of difficulty of breathing and "stoppage" in his nose. On making an examination, I found two pale pinkish yellow swellings, blocking up each nostril. They were rather tense, did not pit on pressure, nor show signs of fluctuation. The patient had at the time been convalescent from his attack of fever for seven weeks; that is to say, he had been going regularly out of doors during that period, and he stated distinctly that until a week before he had never felt anything the matter with his nose. On making an incision into one of the tumors, pus freely poured out, and on pressing the other tumor, it was also completely emptied, a small quantity of chalky matter coming away with the contents. On passing a probe, an oval opening, nearly half an inch in length and a quarter of an inch in height, was found at the anterior part of the cartilaginous septum. An incision was made into the other abscess, not previously opened, and rapid healing took place, leaving, of course, the perforation in the septum already described.

FOREIGN BODIES IN THE NOSE.

Latin Eq.—Corpora adventitia in naribus.
French Eq.—Corps étrangers des fosses nasales.
German Eq.—Fremdkörper in der Nasenhöhle.
Italian Eq.—Corpi stranieri nelle narici.

Definition.—Foreign substances lodged in the nose, most commonly gaining access by the nostrils, but occasionally passing upward from the throat or penetrating the integuments.

History.—The literature of foreign bodies impacted in the nasal channels consists almost wholly of scattered cases reported in medical treatises and periodicals. Among the most remarkable examples on record may be mentioned one [1] in which a fragment of an explosive shell remained in a man's nostril for seventeen years, and finally found its way out; and another [2] in which a musket-ball was lodged within the patient's nose for twenty-five years without its existence being discovered. Several instances have been reported by Renard,[3] Boyer,[4] and others,[5] in which vegetable bodies lodged within the nose have, to the great discomfort of the patient, germinated *in situ*. Remarkable examples of the long sojourn of foreign substances within the nasal cavity have been related by Hickman [6] and Tillaux,[7] and an interesting paper has been written on the whole subject by Bron.[8]

Etiology.—The accident most frequently happens to children, who amuse themselves by putting beads, peas, beans, and other small bodies into their noses. Insane people also sometimes introduce foreign bodies into the nasal cavity. In vomiting, hard substances, such as fruit stones, which had previously accidentally reached the stomach, have been forced into the nasal passages and have become impacted there. The accident is, of course, more likely to occur if the soft palate is paralyzed. Further, foreign bodies may occasionally be driven into the nares from below, when a person swallows "the wrong way," the effort to prevent the foreign sub-

[1] Ephem. Nat. Cur., Dec. iii. ann., v. et vi., obs. 300.
[2] Ibid., Cent. x., obs. 80.
[3] Journ. de Médecine, t. xv., p. 525.
[4] Traité des Malad. chirurg., Paris, 1846, t. v., p. 65.
[5] Blasius: Obs. Med. Rarior, p. ii., No. 8; and N. Act. Nat. Cur., vol. vii., obs. 20.
[6] Brit. Med. Journ., 1867, vol. ii., p. 266.
[7] Bull. de la Soc. de Chir., January 26, 1876.
[8] Gazette Médicale de Lyon, 1867, No. 36.

stance passing below the glottis, causing it to be forcibly driven up into the nose. An extraordinary instance is related by Hickman,[1] in which he removed from the posterior nares of a girl a steel ring, three-quarters of an inch in diameter and half an inch wide, which had been lodged there for thirteen years and a half. Portions of knives,[2] bayonets,[3] or bullets[4] that have pierced the skin sometimes become lodged in the nasal fossæ, but such bodies usually give rise to wounds, without becoming themselves impacted. A case is recorded by Legouest,[5] in which a carpenter stabbed a man in the nose with a pencil, the broken end of which was subsequently removed through the nares.

Symptoms.—Foreign bodies, when introduced by children or insane persons, generally lodge in the lower part of the nasal fossæ, but this is by no means an absolute rule. The symptoms depend on the size, form, and nature of the foreign body. If the substance be small and round, it may remain for a long time in the nose without producing any symptoms at all. Vegetable bodies, however, such as peas or beans, imbibe moisture, and thus swell considerably. As already remarked, they sometimes germinate in the warm, moist atmosphere of the nasal chambers, and they may thus give rise to very troublesome symptoms. In Boyer's case a haricot bean shot out ten or twelve roots, and produced the appearance of a polypus, for which it was, in fact, mistaken. If the foreign body is sharp-pointed or irregularly angular in shape it causes very great irritation, and an attack of acute rhinitis frequently supervenes. When the substance is large, more or less obstruction of the passages is produced, and the patient is obliged to keep his mouth constantly open. In the earlier period there is often intense headache with pain in the nose and cheek, and these pains occasionally assume a distinctly neuralgic character. A very instructive case of this kind has been published by Verneuil, in which the pain came on two or three times a month, and perfectly simulated facial neuralgia. If the foreign body remain in the nose for any time, the acute rhinitis gradually passes off, leaving, however, in its place, obstinate chronic inflammation and an extremely fetid discharge from the nostrils.

Diagnosis.—The recognition of the accident presents no difficulty, if there be a clear history of the introduction of a substance into the nasal passage, but in many cases such information will not be forthcoming, either from wilful suppression or genuine ignorance. When, therefore, a case of fetid discharge from the nostril is met with, especially if the patient is a child, the possibility of the complaint being caused by the presence of a foreign body should always be borne in mind, and a thorough examination of the nasal fossæ should be made, both from the front and from behind. As, however, an impacted foreign body is very likely to be covered with mucus, the nasal passages should be washed out with a spray of tepid salt water before rhinoscopy is practised. If careful inspection should fail to detect any foreign substance, a search should still be made with the nasal probe; and in order that the examination may be quite satisfactory, it may be necessary, in some cases, that the patient should be rendered insensible.

Prognosis.—The prognosis is almost always favorable, for the foreign

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[1] Loc. cit. [2] Legouest: Traité de Chirurgie d'Armée, Paris, 1863, p. 383. [3] Ibid.
[4] Lemaistre: Bull. de la Soc. Anat., October, 1874, p. 632. Lawson: Diseases and Injuries of the Eye, second edition p. 336. Gaujot, quoted by Casabianca: Des Affections de la Cloison des Fosses nasales, Paris, 1876, p. 22.
[5] Op. cit., p. 383.

body can, in the majority of instances, be easily removed, and then all the symptoms rapidly disappear.

Treatment.—The foreign body should be extracted as soon as practicable, but it should be remembered that the condition is not in itself dangerous, and that therefore there need be no undue haste in carrying out treatment. A thorough inspection of the nasal cavities should first be made with the help of the speculum, and if this does not prove successful the offending substance should be searched for with the probe. If the examination is badly borne, and especially if the patient is a child, an anæsthetic should be administered. When the situation of the foreign body has been accurately determined by either of these methods, it should be removed with fine forceps, bent at the proper nasal angle (see Fig. 39, p. 178). Sometimes when the foreign body is situated very far back, as in Hickman's case already referred to, it may be more easily removed by means of forceps passed through the mouth behind the soft palate. Gross' spuds and hooks (Fig. 70, p. 195), may be useful for the extraction of peas and seeds of various kinds. Should it be found impossible by careful exploration to discover the whereabouts of the foreign body, or should the latter be so firmly impacted that it cannot be dislodged without using undue violence, other measures must be resorted to. If the patient be an adult, or a child who has attained the age of eight or nine years, it is a good plan to make use of the continuous douche, a little warm salt water being passed up the free nostril and brought out through the side where the substance is lodged. When the foreign body is small, a pinch of strong snuff will often enable the patient to expel it by sneezing. An ingenious, but unpleasant, method was adopted in a case related by King.[1] A cherry-stone had become impacted in a child's nose and could not be dislodged; at last a powerful emetic was given, and when vomiting was about to commence a handkerchief was held tightly over the little patient's mouth, so that the fluid was thrown through the nares, washing out the foreign body in its course. If it can be avoided, it is very undesirable to attempt to push the foreign substance backward, in the manner sometimes recommended, as there is danger of its falling into the larynx; but if the body is large and tightly impacted into the posterior part of the nares, the practitioner may be obliged to risk this accident. He should, of course, take the precaution of introducing his left index finger through the mouth into the naso-pharynx, while with the right hand he is manipulating through the front of the nose.

If the substance be large, and the symptoms caused by its presence very troublesome, Rouge's operation (see Fibrous Polypi of the Naso-Pharynx) may be necessary.

RHINOLITHS.

History.—The earliest allusion to these deposits is in a work by Matthias de Gardi,[2] who, however, merely mentioned, somewhat vaguely, a case at second hand. Two examples were observed by Bartholin,[3] one apparently of spontaneous origin, the other containing a cherry-stone as a nucleus. Clauder,[4] Kern,[5] and Reidlinus,[6] each recorded one case, and Wepfer[7] described two instances of the complaint. In 1733 a case was

[1] Am. J. Med. Sci., April, 1860. [2] Pratica., Venetiis, 1502, pars. ii., cap. 14, p. 308.
[3] Hist. Anatom. Rar., 1654, cent. i., p. 47; also cent. iv., p. 404.
[4] Ephem. Nat. Curios., 1685, dec. ii. ann. xiii., obs. 78.
[5] Ibid., 1700, dec iii. ann. v. and vi., obs. 43, p. 100.
[6] Ibid., 1706, dec. iii. ann. ix. and x., obs. 145, p. 268. [7] Observ. 192, p. 905. 1727.

related by the great anatomist Ruysch,[1] and soon afterward Plater[2] discussed the origin of nasal concretions. Other examples were recorded by Savialles,[3] Grafe,[4] Thouret,[5] Axmann,[6] Brodie,[7] and Demarquay.[8] The last-named author, in describing a case of nasal calculus, which he had had an opportunity of observing while it was under the care of Blandin, discussed the whole question of the origin, symptoms, composition, and treatment of these bodies, and collected all the previously recorded cases that he could find. It is, in fact, to his careful account of the literature of the subject that I am mainly indebted for the above brief historical summary. Cases have since been reported by Cook,[9] Kostlin,[10] Rouyer,[11] W. N. Browne,[12] Verneuil,[13] West,[14] Roe,[15] Hering,[16] and Nourse.[17]

Rhinoliths generally owe their *origin* to the accidental impaction of small foreign bodies around which the salts of the pituitary secretion collect. Thus in Hering's case the nucleus of the formation was a button, which had become firmly fixed in the nasal passage of a boy aged fourteen. Gräfe suggested that rhinoliths are usually of gouty origin, but out of fifteen cases collected by Demarquay there was only one in which a gouty diathesis could be distinctly recognized. Occasionally in the centre of the calculus an albuminous liquid or a fatty proteine substance has been found, but it appears doubtful whether in these cases the matter contained in the centre of the calculus was the remains of the original morbid secretion, or whether it was due to the softening of some foreign material primarily forming the nucleus of the stone. Chronic inflammation no doubt promotes further deposition, and may in some cases give rise to the original formation. Any cause which obstructs the outflow of the secretion may lead to the formation of a calculus. In Browne's case the nostril had been blocked up for some years.

The *symptoms* caused by rhinoliths are similar to those already described as being produced by foreign bodies; but they generally come on more slowly, and as the calculus continues to increase in size, in the end they cause more inconvenience. A fetid discharge is usually the most troublesome feature of the complaint. The shape of the stone varies, but it is generally irregularly oval, and varies greatly in size. In Browne's case it attained the enormous dimensions of an inch and three-quarters in length, one inch in breadth, and nearly half an inch in thickness, while its weight was three drachms and thirty-three grains. When the calculus is situated in the upper and anterior part of the nasal cavity it may cause a swelling on the face (see Case 2 below), and under these circumstances the lachrymal canal is apt to be obstructed. The stone is usually single, though occasionally, as in the cases of Axmann and of Blandin, several calculi may be present, and in one of my own cases (No. 1) there were two. Their surface may be smooth, but, as a rule, it is somewhat rough and

[1] Obs. Anat., Amstelodami, 1733. Obs. 44, p. 42.
[2] De Olfactûs Lesione, 1736, lib. i., c. 9, p. 264.
[3] Bull. de la Faculté de Méd., 1814, t. iv., p. 44.
[4] Annales d'Oculistique, 1828, t. viii., 4e et 5e livraison, p. 203.
[5] Arch. Gén. de Méd., 1829, t. xix., p. 27.
[6] Ibid., 1829, 1re série, t. xx., p. 102.
[7] Lancet., January 6, 1844.
[8] Arch. Gén. de Méd., 1845, 4e série, t. viii., p. 174 et seq.
[9] Ranking's Abstracts, 1847, vol. vi., p. 132.
[10] Würtemberg Corresp.-Blatt, 1854.
[11] Bull. de la Soc. Anat. de Paris, 1857, p. 60.
[12] Edin. Med. Journ., 1859, vol v., p. 50.
[13] Gaz. des Hôpitaux, 1859, p. 25.
[14] Lancet, 1872, vol. i., p. 147.
[15] Archives of Laryngology, 1880, vol. i., No. 2, p. 149 et seq.
[16] Monatschr. f. Ohrenheilk., 1881, No. 5.
[17] Brit. Med. Journ., October, 1883, p. 728.

mammillated, and their color is most frequently grayish-black. Sometimes they are partly covered by the mucous membrane, in which they have become imbedded, the edges of the membrane being, under these circumstances, puffy and ulcerated, and disposed to bleed.

The *diagnosis* is often very difficult; indeed, a calculus cannot always be readily distinguished from an osteoma, and owing to the fungous bleeding appearance of the mucous membrane, and the great swelling which may be present, a rhinolith has even been mistaken for cancer.[1] If the calculus is movable, or if its surface can be penetrated by a sharp probe or needle, it is not likely to be confounded with an osteoma. The slow course of the disease, and the absence of pain, serve to distinguish it from cancer, while the most casual examination will at once enable the experienced surgeon to recognize a polypus. The composition of nasal calculi is very simple, for they merely consist, as Prout[2] has shown, of mucus and phosphate of lime. They are generally hard on the surface, and softer toward the centre, an outside wall being formed round them, and constituting a covering something like an egg-shell. This, however, is not an invariable rule, for in one of my cases the calculus was of extreme hardness throughout. The *prognosis* is favorable, as, when once discovered, the stone can nearly always be removed, and the patient cured. The *treatment*, consisting, as it does, in extraction of the calculus, can usually be carried out with common polypus-forceps; but if the stone has attained to too great dimensions to permit of its immediate removal, it should first be crushed with a lithotrite of a size and shape suitable for use within the nasal cavity. In one of my cases the stone could only be brought away after being cut through with powerful bone-forceps. Hering having failed to get the stone out with forceps, pushed it backward through the posterior nares, when the patient himself was able to "hawk" it out.

The following examples of this complaint have occurred in my own practice:

Case 1.—James S., aged thirty-seven, a gentleman's servant, applied at the Throat Hospital in May, 1876, on account of a discharge from the left nostril, from which he had suffered for six years. On examining the nose a calculus was seen in the middle meatus. The stone was in a great measure covered by mucous membrane, which had grown over it. Several attempts at extraction were unsuccessful, and it was only after making an extensive incision along the lower border of the middle turbinated body that the calculus was brought away in several fragments. The patient was subsequently treated with mild alkaline washes, and at the end of six weeks had completely recovered; the nasal passages being perfectly clear, and there being no discharge. From an examination of the fragments, it appeared that there had been two oblong stones placed in a line one with the other, and touching at one end. One of them measured a centimetre and a half in length and eight millimetres across, the other was rather smaller; neither of them appeared to have any nucleus. The surface of both calculi was harder than the interior, and of a lighter color. They weighed together forty-seven grains.

Case 2.—Mr. H. S., aged sixty-three, a Government official at Jamaica, consulted me in June, 1882, on account of a troublesome discharge from the right nostril. He had previously seen several practitioners with reference to his ailment, one of whom had told him that he had a polypus in his nose, while another assured him that he had nothing the matter with him, and a third frankly confessed himself unable to discover the cause of his complaint. Mr. S. had resided for some years in the tropics, and had suffered from severe attacks of ague, but otherwise he had been a very healthy man till about four years before he came under my notice, when he had been treated for stone in the bladder, and a "mulberry" calculus had been removed by crushing.

On inspection I found the right side of the nose from near the angle of the eye to

[1] Jacquemin, quoted by Spillmann: Dict. Encycl. des Sci. Med., t. xiii., p. 24.
[2] Lancet, January 6, 1844.

the upper border of the lower lateral cartilage filled out by a hard tumor, the skin over it being perfectly healthy. A dark brown fetid discharge came from the right nostril, and on examining the interior of the nose with the speculum, the right nasal cavity was found to be occupied by a large calculus extending from the level of the inferior turbinated body to the roof of the nose. The surface of the stone was rough, of a grayish black color, and very hard. On attempting extraction with forceps, some small fragments were got away, together with a little slimy grit, but no sensible diminution in the size of the calculus was effected. I subsequently attempted to use a lithotrite, but owing to the shape, hardness, and situation of the stone, I found it impossible to crush it; I finally succeeded, however, in dividing it with powerful bone-forceps. Even then the large fragments could not be extracted. As a last resource I passed a string through the nose into the mouth, and having attached a strong plug of lint to the distal end, drew it forward again through the nasal fossa, and in this manner managed to bring the divided stone within reach of the blades of the lithotrite, and finally to crush it. On examining the fragments no nucleus could be discovered, but if there had been one it might easily have eluded observation. The total weight of the *débris* was seventy grains. Considerable hemorrhage followed this operation; and rather extensive facial cellulitis,[1] without, however, very marked pyrexia, supervened on the following day. This lasted for nearly a week, and recurred on four subsequent occasions at intervals of a few days, although no further operation was attempted. By the time Mr. S. had recovered from these attacks his leave of absence had expired, and he was obliged to return to Jamaica. Unfortunately a small fragment of the stone still remained in the extreme upper part of the nose, and this is very likely to become enlarged by further accretions.

MAGGOTS[2] IN THE NOSE.

Latin Eq.—Myasis narium.
French Eq.—Larves dans les fosses nasales. Myase du nez.
German Eq.—Würmer in der Nasenhöhle.
Italian Eq.—Larve nelle fosse nasali.

Definition.—Destruction of the soft tissues, and sometimes of the bones, of the nose, by maggots hatched from eggs deposited within or close to the nostrils, by dipterous insects, causing gnawing pain, insomnia, and sometimes convulsions, coma, and death.

Though this affection is the cause of widespread suffering among the native population of our excessive tropical possessions, it is scarcely referred to in any standard English work. Indeed, in the entire medical literature of the world there is not a single essay dealing fully with the whole subject. Under these circumstances it seems to me desirable to lay before my readers an analysis of the scattered articles which have appeared from time to time, for the most part, in rare books or inaccessible journals.

History.—Previous to the present century there are only a few examples of myasis of the nose on record. Gahrlieb[3] reported an instance in which a peasant, afflicted with great pain in the forehead and root of the nose, made a decoction of pungent herbs, and inhaled the steam. Epistaxis came on, and was followed by the expulsion

[1] Hack (Beiträge zur Rhinochirurgie. Wien, 1883, p. 24) has recently drawn attention to the fact that a tendency to a low form of erysipelas of the neighboring parts of the face is a not unfrequent complication of inflammatory disease within the nose.

[2] This subject has been briefly referred to in some text-books under the general head of Parasites in the Nasal Fossæ, but this designation is inaccurate. Maggots can hardly be said to be *parasites*, for, as Moquin-Tandon (Eléments de Zoologie Médicale, Paris, 1859, p. 215) points out, the essence of parasitism consists in the remarkable fact that an individual may live at the expense of another, without any very serious results occurring to the animal fed upon

[3] Ephem. Nat. Curios., Dec. iii., ann. vii. et viii., obs. 141, p. 260.

of several living maggots. The next case is that of Behrends,[1] who treated a woman, suffering from unbearable headache and slight swelling of the face, by injecting into the nose decoctions of tansy, rue, and absinth. Thirty maggots were brought away, and the patient was cured. A still more striking example of myasis was published twenty years later by Wohlfahrt,[2] in which a patient suffering from terrific headache was treated by inhalations of alcohol, and eighteen maggots were brought away. These were placed in a box, and in thirty days developed into flies. Fifty years later, a case in which an infant eight months old expelled some worms from the nose was briefly referred to by Tengmalm,[3] and toward the end of the last century, Azara[4] had several opportunities of witnessing the effect of maggots within the nose, in Paraguay. In 1830, Macgregor[5] published an example of the disease, which he had observed in British India. Cases met with in the same country have since been reported by Lahory,[6] Moore,[7] and Ohdedar[8]; while the affection was closely studied by Coquerel[9] in Cayenne; by Morel,[10] Gonzalez,[11] Jacob,[12] and Weber,[13] in Mexico; and by Frantzius,[14] in Costa Rica. In Europe, Mankiewicz[15] reported a case which had been treated by himself, Moquin-Tandon[16] related examples which had been witnessed by D'Astros and others, and an instance was recorded by Petrequin,[17] which he had met with in Italy.

Of the observations made in *British India*, Macgregor's was the first. The patient was a man who for three months had felt pain in the left cheek and inside the nostril. On blowing his nose violently some worms came out, which alarmed him very much, but gave him some relief. Subsequently his cheeks swelled, a fetid bloody discharge issued from the nose, he became greatly excited, and had attacks of shivering; ammonia was used to excite sneezing, and about a hundred larvæ were expelled. They were about half an inch in length, thinner at the front than behind, segmented, and without feet. Their color was white, but they had black spots at the posterior extremity.

Lahory, a native practitioner, educated in the European system of medicine, wrote an interesting article on "Peenash,"[18] a term used in Hindostan for an ulcerative disease of the nose in which maggots are present. He states that he has seen it in patients of all ages, from nine years to eighty, and that it is most common in the hot weather,

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[1] Scharschmidt's Med. und Chir. Nachrichten, Berlin, 1743. 1 Jahrg., p. 214.

[2] Observ. de Vermibus per Nares Excretis, Halæ Magdeburgicæ, 1768. These cases will all be found in Tiedemann (Würmer in den Geruchsorganen, Mannheim, 1844), but the reader who is anxious to pursue the subject will find these and many other references in Ploucquet's laborious Index (Literatura Medica Digesta, Tubingæ, 1809, sub voce Vermis).

[3] Kongl. Vetenskaps Academiens Handlingar, 1796, p. 285.

[4] Voyages dans l'Amérique méridionale, 1781–1801, par Don Félix de Azana, with notes by Cuvier, Paris, 1809, t. i., p. 216.

[5] London Med. and Phys. Journ., 1830, vol. lxiv., p. 498 et seq.

[6] Edin. Med. Journ., October, 1856, vol. ii., pp. 371, 372.

[7] Indian Med. Gazette, 1871.

[8] Ibid. 1881, vol. xvi., p. 80.

[9] Archiv. Gén. de Méd., 1858, t. ii., p. 513 et seq. See also Annales de la Soc. Entomologique, 1858, p. 173.

[10] Recueil de Méd. Milit., 1865, 3e série, t. xiv., p. 516 et seq.

[11] La Mosca Hominivora. Disertacion leida en la Academia Medico-farmaceutica de Monterey la noche del 3 de Marzo, 1865, por el Profesor de Medicina y Cirugia D. José Eleuterio Gonzalez.

[12] Rec. de Méd. Milit., 1866, 3e série, t. xvii., p. 58 et seq.

[13] Ibid., 1867, 3e série, t. xviii, p. 158, et seq.

[14] Virchow's Archiv, Bd. xliii., p. 98.

[15] Ibid., 1868, Bd. xliv., p. 375.

[16] Elém. de Zoologie Médicale, Paris, 1859, p. 212.

[17] Fricke u. Oppenheim's Zeitschr. f. d. gesammte Med., 1838, p. 276.

[18] The word is said to be of Sanskrit origin, but its resemblance to the French word *punaisie* is very remarkable, and it is not impossible that the term now used in India may have been introduced by the French at Pondicherry. On the other hand, it is possible that both words are derived from a common root (see foot-note 2, p. 230). If it could be shown when the term was first employed, it would have an important bearing on the etymological question. It may be remarked that camels in India are commonly led about by a ring which passes through the cartilage of the nose, and the ulcerated surface is constantly covered with maggots, the animals being said to suffer from "Peenash" (Moore: Native Practice in Rajpootana, Ind. Med. Gaz., 1871).

from July to September. He observed that bad food and dirt predispose to the disease, and that it is most frequently seen in persons whose noses are flattened from falling-in of the bridge. The symptoms which he noticed were deep-seated indescribable pain over the frontal sinuses, in the orbits, and in the ears, with a crawling sensation inside the nose. Epistaxis very often occurred. The patient had a disposition to hold the head down, and there was so much ecchymosis and swelling of the eyelids that vision was often obstructed. As the disease went on, ulceration of the nose took place, and a large portion of the organ frequently sloughed away. There was often high fever, with severe constitutional symptoms. At Allyghur, between December, 1851, and March, 1855, there were 91 admissions to hospital for "Peenash." Of these cases 46 were cured, 14 relieved, and 29 ceased to attend, while 2 died. Lahory describes the maggots as being white or yellow, and often having black spots on the head or tail, their size being that of the ordinary maggots seen in putrid animal matter. They have a distinct head, eyes (?), mouth, body, and a tail generally arranged in eleven spiral turns, each spire being a separate joint, by means of which the animal moves. The worms are free, or loosely confined in membranous cysts. The treatment recommended by Lahory consists in the injection of turpentine or infusion of tobacco, combined with the internal use of alteratives and tonics.

In the case of "Peenash" recently described by Ohdedar, a native surgeon in the Indian service, the patient was a woman, about whom a disagreeable smell was noticed, but whose nose only showed thickening of the mucous membrane. In the hard palate, however, there was an opening of the size of a four-anna piece (a centimetre and a half in diameter), and through it eight maggots were removed, each having a distinct nidus. Epistaxis occurred on more than one occasion, and there was subsequently œdema of the face and eyelids. The throat and nose were syringed with a weak solution of muriate of iron, and afterward with oil of turpentine. Ulceration took place near the inner canthus of both eyes, and through the broken skin maggots escaped, causing great pain. Erysipelas of the nose and eyelids ensued, and the patient ultimately died from coma.

Of the information collected in *South America*, that obtained by Coquerel is of great value. This surgeon, an officer in the French naval service, temporarily stationed at Cayenne, in French Guiana, has given the most detailed report of myasis of the nose which has yet been published. He does not appear to have seen any patients himself, the cases having been treated by his brother officers, MM. St. Pair and Chapuis, but he had access to their reports, and was able to determine the class of insect whose larvæ caused the disease. In his article it is not stated whether flies deposited the eggs within the healthy nose, or whether, as in the case of the Indian "Peenash," the maggots were only found when the mucous membrane was in a morbid condition. The principal symptoms noticed at Cayenne were formication in the nose with severe frontal headache, accompanied in some cases by a sensation resembling "blows with an iron bar;" there was also œdematous swelling of the nose, extending over the face, and especially involving the eyelids. Severe epistaxis was often met with, and not unfrequently there was considerable inflammation of the internal tissues of the nose, which in some cases spread to the meninges, and thus caused death. Tumors occasionally formed on the outside of the nose, which after "pointing" opened spontaneously, and from them large numbers of larvæ escaped. When the nose was syringed with a solution of alum or a decoction of tobacco, a quantity of larvæ were frequently expelled, the aggregate number in a single case sometimes amounting to two or three hundred. In the patients that recovered, the septum was frequently in a great measure destroyed, and in many cases the nose was almost eaten away. Of six men treated by St. Pair, three died with symptoms of meningitis; while in two of the survivors the nose had completely disappeared, and in one it was terribly deformed. In the fatal cases the meninges were found of a deep red color and full of blood, especially at the base of the brain. The cerebral substance itself was injected, and the ventricles filled with bloody serum. One patient who had nearly recovered was attacked by erysipelas of the face and scalp, from which he died; and in this case, at the post-mortem, bundles of larvæ were found encrusted in the frontal sinuses and antrum. Coquerel states that the surgeons at Cayenne generally insufflated alum, or injected a decoction of tobacco, but with indifferent success, as this treatment often made the membrane puffy, and closed the openings into the sinuses. He observes that if killed, the maggots no doubt often putrefy within the sinuses, and thus give rise to new symptoms. When there was reason to suspect that they had entered the frontal sinuses or the antrum, the Cayenne surgeons trephined these cavities. Coquerel carefully describes the insect which causes this fatal disease. The account of the maggot, pupa, and fly, as given by him, will be deferred to Etiology (p. 314), as it serves as the standard description of the insect.

When it was decided by the French Government, in 1862, to send a military expedition to Mexico, the Conseil de Santé directed the army surgeons to collect all the information they could concerning the disease produced by the entrance of flies into the nose; but, as far as I have been able to ascertain, the only officers who responded were Morel, Jacob, and Weber. The information, however, which they collected in *Mexico* added to our knowledge of the disease, and led to more certain methods of cure.

Morel based his observations on five cases which had come under his own notice. He thinks that the fly always enters the nose during sleep, and believes that dirty people and those suffering from ozæna are particularly liable to be attacked. In four out of his five cases such persons were the subjects of the disease, while in the fifth the patient was suffering from a boil close to the spot attacked. Morel observes that in the nasal fossæ, the mucous membrane and all the tissues are rapidly reduced by the maggots to the condition of a pulp, while the cartilages and bones are laid bare and soon become necrosed. His article is specially remarkable on account of its containing Assistant-Apothecary Dauzats' recommendation of the use of chloroform as a specific for the destruction of maggots. He advised that chloroform diluted with half its volume of water should be shaken up, and injected before the two liquids have time to separate. Morel observes that all the patients on whom he used this remedy recovered as if by magic, except one on whom it was tried too late. Inhalation of chloroform generally detaches and brings away the larvæ at once, but if they are very deeply situated it should be injected.

Jacob learnt from the natives that the malady was tolerably common among them. They attributed it to a neglected cold, and hence regarded coryza with considerable dread. He reports a very severe case of myasis, which was cured by the use of chloroform injections and inhalations. *Pure chloroform* was injected several times. Although Jacob's paper was published subsequently to that of Morel, he claims to have invented the treatment after trying it with Dauzats on worms.

Weber spent a considerable time in Mexico between 1862 and 1866, especially at Orizaba, Cordova, and Monterey, where, though the disease is said to occur, he did not see any cases himself, his information being principally derived from the published works and oral communications of Dr. Gonzalez. The highest situation at which the fly is found is at Orizaba, which is 1,200 metres above the sea-level, the point of greatest prevalence being at Acatlan, one of the hottest places in the southern part of the province of Puebla. The disease does not seem to be very common in Mexico, for in about twenty years Gonzalez had only collected fifteen cases; of these six died, four recovered with more or less destruction of the nose, and five were cured without any deformity. He points out that the most troublesome symptom is the insomnia caused by the movements of the worms at night. In the cases which had come under his notice the nasal fossæ, frontal sinuses, orbits, mouth, and sometimes the muscles and the skin of the face, were attacked, and once the entire face was destroyed. Gonzalez describes a case in which a young man saw a fly buzzing round him,[1] and tried to drive it away, but did not succeed, and it flew into his right nostril with great force. In the act of sneezing, which soon after occurred, the fly was driven out. Formication in the nose immediately came on, together with a little fever, and subsequently about a dozen large maggots were expelled. Others could be seen moving about in the nose in the midst of sanguinolent mucus. The patient suffered from sleeplessness, and epistaxis came on after many injections had been used. Altogether one hundred and thirty-four maggots were expelled, in addition to those which the patient sneezed out before he came under treatment. He left the hospital cured on the 4th of September, having been admitted on the 28th of the previous month. From this it will be seen how rapid is the course of the disease in a favorable case.

Before dismissing the descriptions by the French surgeons in Mexico, it may be observed that none of them appear to have made any special investigations respecting the natural history of the fly which causes so much havoc. This subject is indeed only referred to by Weber, who observes that he fully endorses the description of the fly given by Coquerel.

Frantzius, a German physician practising in the nearly adjoining region of *Costa Rica*, published some interesting remarks on the disease now under consideration. He observed that sneezing was an early and constant symptom, and attributed it to the tickling sensation caused by the gliding movement of the larvæ when they were seeking a suitable nidus. Considerable swelling and slight redness of the face were gener-

[1] Moquin-Tandon observes (op. cit., p. 225) that the gadfly can often be seen hovering round a sheep, trying to enter its nose, while the sheep buries its nose in the turf in order to prevent the insect getting in.

ally present, but the fetid, sero-sanguineous discharge from the nose, which, according to this observer, only becomes purulent after the expulsion of the larvæ, was a distinctive feature. The larvæ showed a preference for the floor of the nose posteriorly, and hence swelling of the soft palate was not unfrequently seen. In these cases the voice had often a nasal tone. There was usually some fever together with loss of appetite, and occasionally diarrhœa. Frantzius considered that the frontal symptoms often noticed were not due to the presence of worms in the sinuses, but to the extension of the inflammatory process to the mucous membrane lining these cavities. In one instance he removed ten maggots, in others from thirty to fifty. In the only case that ended fatally a hundred were taken away. The patient was an old woman, and Frantzius observes that the presence of larvæ in the nasal fossæ is a very serious condition when occurring in the aged and debilitated. The not inconsiderable destruction of tissue, the incessant discharge, the violent headache, the loss of sleep, and the constant fever, all tend to undermine the vital powers. He recommends the insufflation of calomel and powdered chalk (equal parts), and the removal of larvæ with forceps, pointing out that the fact of their being clustered closely together facilitates this procedure. Frantzius does not attach much importance to the various remedies which have been recommended for these cases, and believes that many of the supposed curative agents owe their apparent efficacy to the fact that when they were used the maggots had attained their full duration of larval life.[1]

In addition to the older cases already briefly referred to at the beginning of this historical sketch, four others have been recorded in the present century, as occurring in *Europe*. Petrequin, while making a tour in Italy, observed one in a hospital at Sienna. A woman, who complained of an extremely painful red swelling on the right cheek, and had some fever and slight delirium, passed several small white maggots from the nose. Curious as it seems, anthelmintic remedies were prescribed internally, and she was ordered to use them also as an inhalation. In the course of eight days, fifty-eight maggots were expelled, and these subsequently developed into *lucilia*.

Mankiewicz, a medical practitioner in Berlin, was induced to publish the following case on reading Frantzius' article, of which an abstract has been given: In a delicate boy, aged nine years, suffering from scrofulous ozæna, enormous quantities of maggots were seen adhering to the septum, and it was found impossible to remove them until they had been smeared over with a solution of balsam of Peru. A complete cure was effected, though the boy lost the tip of his nose.

Moquin-Tandon also records the two following cases: In the first the patient was a woman under the care of D'Astros, of Aix (Provence). She had fallen asleep in a field, when it is supposed that a fly deposited its eggs inside the nose. Soon after, slight pain came on in the frontal sinuses, with a sensation of formication about the root of the nose, and a "noise was heard by the patient and *others* like that produced by worms gnawing wood" (!). After severe epistaxis one hundred and thirteen maggots were expelled. In the second case, which occurred in a girl nine years of age, the patient suffered from intense headache and convulsions, but was cured by cigarettes of arsenite of soda.

The only case recorded from the *United States* is one lately published by Prince,[2] of Jacksonville, Ill., in which a fly deposited its ova within the nose of an Irish farmer who was suffering from ozæna. In a short time maggots were developed; erysipelas and œdema of the nose and adjoining parts of the face supervened, and the patient could not breathe through his nostrils. Syringing with water proved utterly ineffectual, and the larvæ were gradually picked out with forceps. They were found to have stripped bare a considerable portion of the bony framework of the nose, and it is asserted that the ozæna was thereby completely cured.

Etiology.—The disease is seldom met with out of the tropics. Elevated situations, owing to their coolness, even in hot climates, are free from this pest, the observations of Gonzalez, already referred to, showing that, in Mexico itself, the affection is not met with at a level higher than 1,200 metres above the sea. Only a very few cases have been described as occurring in Europe. The disease is undoubtedly caused by the hatching of eggs laid by a fly (allied to our bluebottle and meat-fly) within the nose, or close to its orifice. The natural situation for these insects to deposit their

[1] Frantzius seems to be under the mistaken impression that maggots arriving at maturity quit their previous habitat in order to form a cocoon. Their natural history in this respect will be found explained under the head of Etiology.

[2] Philadelphia Medical News, October 14, 1882, p. 445.

eggs is in putrid meat, which affords proper nutriment for the larvæ when hatched ; but instinct sometimes goes astray, as is seen in the case of the bluebottle fly, which occasionally deposits its eggs on the common snake-root (*Arum dracunculus*), being deceived by the cadaveric odor which that plant emits. It is by a similar error of instinct that the fly of hot climates occasionally deposits its ova within the nose. No doubt it is the fetid discharge from the nose which attracts the insect, and it is probably only by accident that eggs are deposited on a healthy mucous membrane. It has already been pointed out, that a great many morbid conditions of the nose are included under the head of "Peenash." In fact, the word corresponds to the vague term "ozæna,"[1] as formerly employed in European medicine, the only difference being that in "Peenash" maggots are sometimes present. The following is the description of the *Lucilia hominivora:* The *fly* is nine millimetres in length, has tawny palps, and a light tawny face, the cheeks being covered with golden-yellow down. The head is large, wider in front than behind, the thorax being dark blue, with black and yellow stripes, and the abdomen of the same color. The feet are black, and the wings transparent. The *larva* is dull white, fourteen or fifteen millimetres long by three or four broad, and narrower in front than behind. It is made up of eleven segments, the widest part of the body corresponding

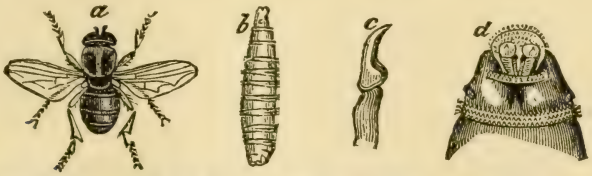

FIG. 87.—Lucilia Hominivora. *a*, the fly ; *b*, larva ; *c*, a mandible ; *d*, magnified view of the insect's head.

with the sixth. The head is indistinguishable from the first segment ; there are no eyes ; the mouth is formed by a sort of lip, on which are two small protuberances, at the base of which near the middle line there are two corneous mandibles placed side by side, the mandibular hooklets being very sharp and separated outside, though closely united in the thickness of the tissues. On each side of the first segment there is a brown corneous patch, which covers the orifices of the upper stigmata. At the base of each segment there is a projecting part, covered with small spines, very numerous and close together.

Macgregor's account of the maggot corresponds closely with Coquerel's, but the maggot described by Lahory is said to have had eyes. As these organs are not found either in the larva of *Lucilia hominivora* or in that of *Lucilia Cæsar* (common bluebottle), Lahory's maggot must have belonged to some other variety, or that observer must have made a mistake. He also speaks of the maggots as being confined within loose membranous cysts, while Ohdedar states that in his case each maggot had a distinct nidus.

There are three kinds of European flies, all belonging to the order of *Muscidæ*, which may deposit their ova within the nose or near its entrance, viz., *Sarcophagæ*, *Calliphoræ*, and *Luciliæ*. The *Sarcophaga* is black, its thorax, however, being streaked with gray, and its abdomen chequered with white. The insect has a small head, its antennal bristle being hairy,

[1] See p. 229.

but naked at the tip. The female is viviparous, the larvæ being hatched within the oviduct. The ovaries often contain as many as twenty thousand eggs. The larvæ are footless, white, fleshy, and narrower in front than at the posterior part. The *Calliphora*, or *Vomitoria*, the common large meat-fly is too well known to require any description; its larvæ are white, and obliquely truncated at the posterior extremity. They have no feet, but have two fleshy horns on the head, and two fleshy hooklets in the mouth. The last segment of the body is provided with eleven points, arranged like rays.

The *Lucilia* is represented by the common bluebottle.

The larvæ of *Dipteræ* develop in seven or eight days in Europe. In the *Muscidæ* the larva changes into a pupa within the larval skin, which contracts into a cylindrical puparium, corresponding in use to the cocoon. The flies almost always deposit their eggs in the light and heat of day.

Symptoms.—After the deposit of the ova, the mucous membrane soon becomes irritable, a constant tickling sensation is felt, and sneezing is a common symptom. In a short time the tickling becomes very troublesome, and a crawling feeling or formication is perceived. This is mostly followed after a short time by a sanious bloody discharge, and epistaxis often occurs. Œdema of the face, and especially of the eyelids, is a characteristic symptom, and swelling of the palate takes place in some cases. Occasionally, but not very frequently, small tumors form over the nose, which open and allow the larvæ to escape. Severe and constant pain is generally felt, especially at the root of the nose and over the frontal region. The headache is often of a throbbing character, and has been described both in India and Cayenne as resembling the sensation which might be caused by repeated blows with a hammer or iron bar. The pain in some cases never intermits, but gives rise to the most distressing sleeplessness, that is, indeed, sometimes so unbearable as to lead to suicide. Larvæ are often sneezed out, or can be seen in the nose crawling about in the fetid mucus. When it is remembered that as many as from two to three hundred maggots are sometimes ejected in a single case, the injury and loss of substance which they can cause will be readily appreciated.[1] Not only is the mucous membrane destroyed, but the cartilages and bones of the nose and head become carious. Convulsions, followed by coma, generally terminate the life of the patient in fatal cases.

Diagnosis.—Although there are many symptoms which might lead to a suspicion of myasis, it is only the actual finding of maggots which can prove its existence.

Pathology.—The morbid changes produced by maggots have already been described in dealing with the symptoms, and it only remains to be remarked here that in cases which have not been treated sufficiently early, not only the soft tissues, but the ethmoid, sphenoid, and palate bones are often destroyed by caries, and that the meninges are found after death to be much inflamed. There is a section of a skull in the Museum[2] of the Medical College at Calcutta taken from the body of a man who died of "Peenash," in which a large number of maggots were found on the sphenoid and ethmoid bones.

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[1] Linnæus states that "three flies devour the body of a dead horse as quickly as a lion" (Syst. Nat. Ed., decima tertia, Lipsiæ, 1788, t. i., par. v., p. 2,840). This extraordinary power of destruction is, of course, due to the rapidity with which the insect passes through its successive stages of development, and to the great number of eggs laid in each cycle when the condition of imago is reached.

[2] See Indian Annals of Med. Sci., October, 1855.

Prognosis.—This disease, if neglected, is probably always dangerous in tropical climates. Its fatality, however, seems to vary greatly in different countries, for while Lahory met with only 2 fatal cases out of 91 patients, of 6 patients seen by St. Pair 3 died. This discrepancy is perhaps to be explained by many cases having been described under the name of "Peenash," in which no maggots are present—cases, in fact, in which there was syphilitic disease of the nose or merely dry catarrh.

Treatment.—Dauzats' discovery of the highly beneficial effects of chloroform will probably cause this remedy to supersede all others. *Inhalations* of chloroform are often sufficient to effect a cure; but should the maggots resist this mode of administration, the patient should be rendered insensible by the vapor, and then equal parts of chloroform and water should be *injected;* or should even this fail, *pure chloroform may be syringed up the nose.* The undiluted chloroform does not appear to do any harm to the mucous membrane, but it causes extreme pain when the patient is not under an anæsthetic. The remedies formerly used, viz., injection of turpentine, infusion of tobacco and lemon-juice, insufflations of calomel, the local application of Peruvian balsam, though all to some extent efficacious, do not seem to be at all comparable in their effects to chloroform. Constitutional treatment must not be neglected: opium should be given to relieve the pain and induce sleep; and if the myasis is complicated by syphilis, iodide of potassium should be administered. Stimulants and highly nutritious food are required to sustain the vital powers.

In the above article the severe nasal affections produced by the larvæ of *Muscidæ* have been considered, and it is only very rarely that other *Dipteræ* deposit their ova within the nose. There are a few cases, however, mostly reported before entomology was studied scientifically, in which the larvæ of the gadfly (*Œstrus ovis*) and of the leather-eater (*Dermestes*) are supposed to have attacked the nose.[1]

The gadfly is a regular parasite of sheep and goats, in the nostrils of which animals the insect constantly lays its eggs. Moquin-Tandon denies that there is any instance on record in which a human being has been attacked; but the following case, reported by Razoux,[2] leaves no doubt as to the occasional occurrence of the accident. A woman was seized with burning fever, inflamed eyes, dry skin, and gradually increasing headache in the frontal region. Tartar emetic was prescribed, to produce vomiting, but with no beneficial result. Attacks of sneezing, however, afterward came on, and the patient expelled from the nose seventy-two live worms of the gadfly. Quite recently, Kirschmann[3] has reported a case in which a peasant woman was attacked with bleeding from the nose which lasted three days. The blood came from the left nostril, and the corresponding side of the face was enormously swollen. The hemorrhage was arrested by injections of perchloride of iron, and this treatment was followed by the expulsion of a mass of maggots of the *Œstrus ovis.* The

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[1] A case is recorded by Hope (quoted by Moquin-Tandon: Elém. de Zoologie Médicale, p. 217) in which it is stated that death resulted from the presence of a meal-worm (*Tenebrio molitor*) in the nasal fossæ, but as this maggot is a vegetable feeder the case must be looked upon with doubt. [2] Journal de Médecine (Roux), tome ix., p. 353. [3] Wien. med. Wochenschrift, 1881, December 3d.

patient made a good recovery. Two cases are on record in which the maggots of the leather-eater are said to have been found in the nose. One[1] was that of a young woman, who complained of great headache, which was entirely relieved by the expulsion of five reddish-brown hairy maggots. The other[2] was that of a man who suffered from excruciating headache, with epistaxis, which lasted three days. After the passage of eighteen small hairy worms from the nose all the symptoms disappeared.

ENTOMOZOARIA IN THE NOSE.

This subject belongs to the curiosities of medical literature, rather than to the domain of practical therapeutics, but among the entomozoaria which occasionally find lodgment in the nasal passages may be mentioned leeches, ascarides, centipedes, and earwigs.

In former times, when leeches were so largely used, it is highly probable that these animals not unfrequently got up the nose. Their size, however, would render them easily visible, and they were no doubt quickly removed with forceps, or expelled by means of injections. That they did occasionally enter the nose is rendered more than probable by the animated discussions which took place in the fifteenth and sixteenth centuries, as to whether leeches could penetrate from the nose into the brain. There are, however, only two cases on record, so far as I have been able to discover, in which it is actually stated that a leech lodged in the nose. One is that of Lusitanus,[3] in which it is said that a man who suffered severely from headache, after every other kind of treatment had failed, had a leech applied to the anterior part of the nose. The animal accidentally crawled into the nasal passages, and could not be removed, and two days afterward the man died. In the other case[4] a student who had suffered for a long time from violent headache, accompanied by epistaxis and sneezing, was relieved of his troublesome complaint by the expulsion of a worm, which closely resembled a leech.

Ascarides are occasionally found in the nose after death,[5] as indeed they are in the larynx and trachea, but in the latter case there is no doubt that the worms creep up into the air-passages from the intestinal canal immediately after the death of the patient, and it is highly probable that the same course of events has taken place when worms have been observed in the nose. There are a few instances, however, on record in which the worms were expelled from the nose during life. Thus Benevenius[6] describes the case of a man who, suffering from delirium and convulsions,

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[1] Paullini: Ephem. Acad. Nat. Curios., dec. ii., ann. v., append., p. 63, obs. 101.

[2] Wohlfart: Observ. de Vermibus per Nares excretis, Halæ Magdeburgicæ, 1768, p. 3 et seq. The case is illustrated by some good drawings.

[3] De Praxi Admirandâ, lib. iii., obs. 61. Amst., 1641.

[4] Ephem. Acad. Nat. Curios., dec. ii., ann. i., obs. 99.

[5] Troja (Rarissima observa to de magno lumbrico in frontali sinu reperto et totam ejus cavitatem replente. Napoli, 1771) found a large ascaris occupying the entire cavity in one of the frontal sinuses of a corpse. Wrisberg (in Blumenbach's Prolusio anatomica de sinibus frontalibus, Gottingæ, 1779, p. 425) also found a similar specimen. Deschamps (Maladies des Fosses nasales, 1804, p. 307) has also reported a case in which an *Ascaris lumbricoides* was found in the antrum after death.

[6] Med. Obs. Exempl. Coloniæ, 1581.

appeared about to die, when he expelled a worm of about five inches in length from the right nostril, and make a good recovery. Forest,[1] Lanzoni,[2] Langelott,[3] Tulpe,[4] Fehr,[5] Behr,[6] Bruckmann,[7] Albrecht,[8] Habber,[9] and Lange,[10] have also reported cases in which the *Ascaris lumbricoides* was expelled from the nose.

Numerous instances are on record in which centipedes have lodged in the nose or its adjacent sinuses for months and even years, no less than ten such cases having been collected by Tiedemann.[11] Most of the patients suffered from agonizing headaches, and some from vertigo and trembling. A case occurred in the practice of Maréchal, of Metz,[12] in which a centipede measuring 6 ctm. in length was expelled from the nose. The patient was a farmer's wife, who had suffered from formication in the nostrils, and a copious discharge of mucus, often fetid and mingled with blood, and from severe headaches, the sensation being compared by the woman to repeated blows with a hammer. She was also troubled with constant lachrymation and vomiting. The unfortunate patient often passed into a state of extreme excitement, and the least noise caused her great torture. There were periods of remission, but she had five or six severe attacks every day, and several during the night. One of them, however, lasted fifteen days without ceasing. The centipede was expelled alive after a year, and was pronounced to be a *Scolopendron electricum*.

Earwigs being only found in cool climates, and then only in the autumn months, when few people live out of doors, seldom have an opportunity of finding their way into the nose. The only case with which I am acquainted is that of Sandifort,[13] in which a woman very fond of smelling strongly-scented flowers was suddenly attacked by great pain in the forehead on the right side, while at the same time a fetid discharge from the nose came on. After inhaling hot steam she expelled a live earwig, when the pain and discharge soon ceased.

The symptoms caused by the various entomozoaria usually consist in sleeplessness, pain in the lower part of the forehead, sanious discharge from the nose, vomiting, lachrymation, and in some cases great cerebral excitement. Sternutatories generally effect a cure, and in one or two instances the expulsion of the worm took place after spontaneous sneezing. Occasionally, however, when these animals enter the frontal sinus, it may be necessary to trephine the bone, and Morgagni [14] reports a case in which Cæsar Magatus performed this operation successfully.

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[1] Obs. et Cur. Med., lib. xxvii., obs. 28, p. 351.
[2] Ephem. Acad. Nat. Curios., dec. iii., ann. ii., obs. 38.
[3] Thomæ Bartolini: Epist. Med., cent. ii., epist. 74, p. 640.
[4] Observat. Med., lib. iv., cap. 12.
[5] Ephem. Acad. Nat. Curios., dec. iii., ann. iii., p. 261.
[6] Act. Physico-Med. Acad. Nat. Curios., t. iv., obs. 30, p. 111.
[7] Commer. Noricum., t. ix., ann. 1739, art. i., p. 113.
[8] Act. Physico-Med. Acad. Nat. Curios., t. iv., obs. 51, p. 158.
[9] Haarlem Verhadl., Bd. x., Heft 2, p. 465.
[10] Blumenbach's Medizinische Bibliothek, Göttingen, 1788, Bd. iii., p. 154.
[11] Würmer in den Geruchsorganen. Mannheim, 1844.
[12] Moquin-Tandon, p. 217. See also Coquerel, loc. cit., p. 525. A similar case will be found reported in the Hist. de l'Acad. des Sciences, Paris, 1709, p. 42.
[13] Exercitatio Acad., Lugd. Bat., 1785, lib. ii., cap. xvii., p. 130. De forficulâ vivâ naribus excussâ.
[14] De sed. et caus. morborum, lib. i., art. ix., Lugd. Batav., 1767, t. i., p. 12.

ANOSMIA.

Latin Eq.—Odoratus perditus.
French Eq.—Perte de l'odorat.
German Eq.—Verlust des Geruchsinns.
Italian Eq.—Perdita del odorato.

Definition.—Loss or impairment of smell primarily dependent on disease of the olfactory nerves or lobes, or of their cerebral centres.[1]

History.—Several cases of anosmia, congenital and acquired, were collected by Bonet,[2] and in 1751 a thesis on loss of smell was written by Bauer;[3] while at the beginning of the present century Deschamps[4] recorded some curious instances of the affection. The whole subject was treated in great detail by Cloquet[5] in 1821, in a work specially devoted to the sense of smell. A very striking instance of the destruction of the sense by too powerful stimulation was reported by Graves[6] in 1834, and soon afterward a case of congenital absence of the olfactory nerves, with complete anosmia, was published by Pressat.[7] Some careful observations on senile atrophy of the olfactory nerves were made by Prévost[8] in 1866; and an essay on various affection of the sense of smell, and the causes producing them, was written by Notta[9] in 1870. In the same year an elaborate article on anosmia was published by William Ogle[10] The subject has recently been treated of by Althaus.[11]

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[1] A remarkable case has been reported by Bérard (Journal de Physiologie expérimentale et pathologique, 1825, t. v., p. 17 et seq.), in which it is asserted that in the case of a man whose sense of smell had been perfect, there was nevertheless found after death complete destruction, not only of the olfactory nerves, but also of the olfactory lobes, of the pedicles which unite them to the surface of the hemisphere in front of the Sylvian fissure, of the fissure itself, and in short, thorough disorganization of the whole olfactory region. The grounds on which it is maintained that the patient retained his sense of smell are, first, that he was able to appreciate the difference between various kinds of snuff; and, secondly, that he was annoyed by the stench of an abscess from which a patient in the next bed was suffering. This evidence, however, appears to me to be inadequate; the pleasurable sensation produced by snuff mainly depending on its stimulating effects on the fifth nerve, the functional activity of which is apparently intensified when that of the olfactory nerve is abolished (see foot-note 1, p. 324). It is more difficult to explain away the patient's dislike of the stench from the abscess, but it is possible that he objected to his neighbor on other grounds than those of smell. *It appears that the sense of smell was never actually tested during life*, and this fact, to my mind, entirely destroys the value of the observation. Desmoulins, in commenting on the above case, adds (loc. cit., p. 17) an account of a patient who had lost his sense of smell on one side, although the olfactory nerves, lobes, pedicles, and the adjacent parts of the brain were perfectly sound. On the same side the ganglion of the fifth nerve had undergone degeneration, the gray matter having been destroyed, and the nerve filaments softened and altered. It is not stated what tests were used in this case for ascertaining the condition of the patient's sense of smell; but if ammonia or some other pungent vapor was employed, as was commonly done at that time, the fallacy of the experiment is obvious. Althaus has published a very complete and instructive case (Med. Chir. Trans., 1869, vol. lii., p. 27 et seq.), in which the mucous membrane of the nose was absolutely insensible to the contact of blunt or even sharp instruments, and no sneezing was brought on by snuff, yet the sense of smell was perfectly normal, the patient having no difficulty whatever in recognizing the different varieties of scents with which he was tested.

[2] Sepulchretum, Genevæ, 1700, t. i., p. 441 et seq.

[3] De odoratu abolito. Altorfii Noricorum, 1751. Sometimes quoted as the work of Jantke, under whose presidency it was delivered.

[4] Maladies des Fosses nasales, Paris, an xii. [1804], p. 56.

[5] Osphrésiologie. Paris, 1821.

[6] Dublin Journ. of Med. Sci., 1834, No. 16.

[7] Obs. d'un Cas d'Absence du Nerf Olfactif, Thèse de Paris, December 18, 1837.

[8] Gazette Médicale, 1866, No. 37, p. 597 et seq.

[9] Arch. Gén., 1870, t. i., p. 385 et seq.

[10] Med.-Chir. Trans, 1870, vol. liii., p. 263 et seq.

[11] Lancet, May 14 and 21, 1881.

Etiology.—Any disease or injury of the olfactory nerves, tracts, or centres is likely to interfere with the sense of smell, but for the satisfactory discharge of the function it is necessary that certain secondary conditions should be maintained. Not only is the integrity of the fifth and seventh nerves essential, but there must not be any mechanical obstruction which prevents the odorous particles from reaching the olfactory region, and the Schneiderian membrane must possess its normal moisture of surface. Further, it is highly probable that the presence of pigment in the cell-processes of Schultze is a necessary condition of healthy olfaction.

Cases are on record in which the exposure of the olfactory nerves to the prolonged action of an exceedingly disagreeable smell appears to have been the cause of injury to the function of this nerve, and it is not improbable that the mode of action of the odor consists in over-stimulation, in the same way that strong light sometimes produces amaurosis. A remarkable case of this sort has been recorded by Bauer,[1] in which a surgeon, who dissected a very putrid body, lost the sense of smell for the rest of his life. Graves[2] has reported an instance in which, during the Irish rebellion of 1798, an officer had to take charge of some soldiers who were engaged for many hours searching for pikes supposed to have been concealed in a very offensive sewer. Next day he perceived he had lost his smell. It might be thought that scavengers would sometimes suffer in a similar manner, but, from inquiries I have made, this does not appear to be the case. The explanation probably lies in the fact that when sewers are at all foul the workmen remain in them only a very short time.[3] The inhalation of strong fumes of ammonia, or other irritant vapors, may likewise affect the terminal twigs of the olfactory nerves in such a way as seriously to impair their function. Snuff-taking sometimes acts in a similar manner.[4] I have seen two cases in which the use of the nasal douche has been followed by permanent anosmia. Wendt[5] refers to three cases within his own knowledge in which the sense of smell was permanently destroyed by the local use of solution of alum. Stricker[6] has reported a case in which the action of sulphuric ether appeared to destroy the function of the olfactory nerves, the patient having been an entomologist, who spent many hours daily in preparing insects which he killed with that vapor. Loss of smell sometimes follows frontal neuralgia,[7] and a case was observed by Maurice Raynaud,[8] in which the loss of function was distinctly periodic, the patient having been a woman, aged thirty-eight, who suffered from anosmia every twenty-four hours from 4 P.M. one day to 10 A.M. the next. She rapidly recovered under the use of quinine. This patient was not in the least degree hysterical, but had previously suffered from crural neuralgia, which had also been cured by quinine. The most common cause of anosmia is prolonged catarrh,[9] few practitioners having failed to meet with some examples. In these cases the cell-processes of Schultze are probably destroyed by cirrhotic shrinking of the inflammatory exudation. A remarkable case has been recorded by J. P. Frank,[10] but

[1] Op. cit., p. 188.
[2] Dub. Jour., 1834, No. 16.
[3] A superintendent of sewers, who had spent a large portion of his life underground, once informed me that the sewers were generally far sweeter than most private houses.
[4] Virchow's Archiv, 1868, Bd. xli., p. 290.
[5] Ziemssen's Cyclopædia, vol. vii., p. 56.
[6] Virchow's Archiv, 1868, Bd. xli., p. 290.
[7] Notta: Archives Gén., 1870, vol. i., p. 385 et seq.
[8] Union Médicale, July 10, 1879.
[9] Ephem. Nat. Curios., dec. iii., ann. iv., obs. 3.
[10] De Curandis Hominum Morbis, Mannhemii, 1793, lib. v., p. 132.

without details, in which he affirms that "loss of smell and taste occurred in a man from a deposit of rheumatic (?) matter on the nose and tongue." Unless this was a case in which a diphtheritic membrane was deposited, it is difficult to understand its nature.

Owing to the extremely soft consistence of the olfactory bulbs, they are occasionally separated from the brain by falls on the head. Sometimes these accidents are accompanied by concussion of the brain, and the anosmia is associated with deafness, ringing in the ears, or even bleeding from one ear; in these latter cases there is probably a fracture of the base of the skull, but in other instances temporary abolition of consciousness and loss of smell are the only symptoms. Such cases are by no means rare, and several have been described by Notta.[1] One instance of this kind has come under my own notice, the patient having been a surgeon, who was thrown from his gig with considerable force, and alighted on his head. He was stunned for a few minutes, and the next day became aware that he had lost his sense of smell. Although this gentleman subsequently recovered his health completely, the anosmia was permanent.

Long-continued paralysis of the fifth nerve interferes with the proper nutrition of the mucous membrane, and peripheral changes of a secondary character may then take place in the olfactory nerves, and thus cause true anosmia. In cases of paralysis of the seventh nerve (portio dura) the patient is unable to smell, for two reasons—first, because he is unable to sniff up the olfactory particles; and secondly, because the orbicularis muscle of the eye being paralyzed the conjunctival fluid overflows on to the cheek instead of passing through the lachrymal duct, causing dryness of the nasal mucous membrane, and so destroying the receptivity of the olfactory nerve.

The influence of obstruction in interfering with the function of smell is seen in the case of polypi and of swelling of the mucous membrane of the nose. When the obstruction, however, is due to nasal or naso-pharyngeal growths, or to adhesions which block up the posterior nasal openings, the patient can smell odorous substances placed near the nostrils, though in eating he can no longer appreciate flavors, and he therefore thinks he has lost his sense of taste.

Moisture of the mucous membrane of the nose is as essential to the sense of smell as that of the tongue is to taste. The influence of the seventh pair of nerves in indirectly causing dryness has already been pointed out, and it is only necessary here to call attention to the arrest of secretion in the first stage of nasal catarrh, which often gives rise to temporary anosmia.

The presence of pigment in immediate contact with the cell-processes of Schultze is probably essential to olfaction in many animals, but, as far as I am aware, Hutchison's[2] case is the only one on record which supports this view as regards the human subject. The patient was a young negro in Kentucky, whose parents were both black, and who up to his twelfth year had the usual dark skin of an African. At this period a white patch appeared near the left eye, which in ten years extended all over the body, so that had it not been for his woolly hair the young man might have been taken for a very fair European. When he first began to change his color, his sense of smell was weakened, and by the time he had become white olfaction was almost completely lost. This

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[1] Loc. cit. See also a case Ephem. Nat. Cur., ann. iv., obs. 3.
[2] Amer. Journ. Med. Sci., 1852, vol. xxiii., p. 146 et seq.

case was passed over as a mere medical curiosity until its importance was recognized by William Ogle.[1] Althaus[2] has recorded the case of a well-known statesman who is an albino, in whose case smell had always been weak, and who lost this sense entirely at the age of sixty-three. Althaus regarded the case as one of "ultimate atrophy of a nerve which had never been highly developed." It appears from the researches of Ogle[3] that the pigmentation of the olfactory region is darkest in those animals which have the most acute sense of smell, and that in the colored races of men this sense acquires a much greater degree of perfection than in the white man. He further points out that it has often been observed that white animals, owing to their defective sense of smell, are more liable than those of a dark color to eat poisonous herbs.[4] Thus, in some parts of Virginia, white pigs are poisoned by the roots of the *Lachnanthes tinctoria;* while in the Tarantino, the inhabitants only rear black sheep, because the white ones are poisoned by eating the abundant *Hypericum crispum* of that region. It is stated also that the white rhinoceros perishes from eating the *Euphorbia candelabrum*, which the dark rhinoceros refuses.

The sense of smell generally becomes impaired in the decline of life—a change probably resulting from atrophic degeneration of both the nerve centre and its periphery.

Defective olfaction is probably sometimes hereditary,[5] and cases of congenital deficiency of the sense of smell have been recorded by Frankenau[6] and Notta.[7] It is not improbable that in some of these instances the cause of anosmia was prolonged nasal catarrh in infancy; but this explanation does not always apply, for congenital deficiency of the olfactory nerves has sometimes been observed (see Pathology).

In conclusion it must be admitted that there are some cases of anosmia in which it is impossible to discover any cause for the loss of function. Several instances of this kind have been reported by Notta, under the term of *anosmie essentielle.*

Symptoms.—Taste is so closely associated with *smell* that it is necessary to make a few observations on the subject of these two senses.

The recognition of the bitter, sweet, salt, and acid characters of food by the tongue and fauces constitutes taste. The appreciation of the *savor* of meat, the *flavor* of fruit, and the *bouquet* of wine, depends entirely on smell. It is necessary to call attention to these facts, because the mistake is not unfrequently made by medical writers, of describing cases as loss of taste, when it is clear from the context that they mean loss of smell. But while taste is rarely impaired, smell is often altogether lost, and the acuteness of the sense varies very much in different people. It is generally somewhat feeble in young children, attains its greatest vigor in adult life, and, as already remarked, becomes dull in old age. It is only when the sense of smell is completely lost that the power of distinguishing flavors is destroyed; people who have no perception of odors diffused in the atmosphere often retaining a keen relish for savory food. Loss of smell may be either unilateral or bilateral, and in the former case it may be of import as indicating localized lesion of the brain, or some disease in the upper part of one of the nasal channels.

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[1] Med.-Chir. Trans., 1870, vol. liii., p. 276.
[2] Lancet, 1881, vol. i., p. 813.
[3] Loc. cit., p. 278 et seq.
[4] Breschet: Dict. des Sciences Médicales, 1819, vol. xxxvii., p. 241.
[5] Loc. cit., pp. 281, 282.
[6] Ephem. Nat. Curios., dec. iii., ann. iv., obs. 3.
[7] Loc. cit.

It has been remarked that in cases of anosmia the sensibility of the mucous membrane to irritants has sometimes become even more acute than it was while the olfactory nerves were in a healthy condition.[1]

Pathology.—The pathology of anosmia is still very obscure, though there are a number of scattered observations on the subject. A remarkable case has been related by Bonet,[2] in which a man who had suffered toward the end of his life from headache, together with blindness and loss of smell, was found after death to have an abscess involving the olfactory bulbs. In a second case, recorded by the same author, an abscess was found involving the olfactory bulbs and causing erosion of the frontal and ethmoid bones. The patient was a man aged twenty-two, who, shortly before death from convulsions, had suffered from headache, blindness, and loss of smell. This was, no doubt, an example of syphilitic disease of the bones. It is more difficult to explain the pathological nature of the following case, which is also reported by Bonet:[3] "A 'stone,' flattened like a coin but not so round, and of an ashy color, was found at the base of the brain, pressing on the sphenoid (*sic*) and olfactory nerves." The patient in whom this was observed had been attacked with fever, accompanied by severe pain and heaviness in the head, and had died nine days after the commencement of the illness. I feel quite unable to make any suggestion as to the nature of the "stone," but the case seems worthy of mention as being the record of a fact by an accurate observer.

As the olfactory nerve-tract can be traced to the island of Reil,[4] to a point not far from Broca's convolution, it might be expected that in aphasic patients anosmia would be often present. But although such cases have been reported by Fletcher,[5] Hughlings-Jackson,[6] and Ogle,[7] the association of these symptoms does not appear to be common. The statistics of Ball and Krishaber,[8] indeed, tend to show that disease of the left side of the brain does not frequently cause anosmia, but that it is more common when the lesion is in the right lobe. Thus, out of 75 cases in which there was a tumor in the left side of the brain, there was not a single instance of anosmia, though aphasia was present in 17. On the other hand, out of 63 cases of tumor affecting the right side, in 3 of which aphasia was a symptom, anosmia was observed in 2. Further, out of 47 cases of cerebral tumor, where the growth was median or bilateral, or where the exact situation was not stated, there were 4 cases of loss of smell; but it is not recorded that anosmia and aphasia coexisted. Although it is evident, from the above statistics, that anosmia is sometimes caused by

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[1] See a case related by Deschamps (Maladies des Fosses nasales, Thèse de Paris, 1804, p. 56), in which a student who had totally lost his sense of smell became, after a time, able to distinguish one kind of snuff from another, simply from their different degrees of pungency.

[2] Sepulchretum, Genevæ, 1700, lib. i., sec. xx., obs. 1, p. 441.

[3] Op. cit., obs. 4, p. 443.

[4] The experiments of Ferrier (Functions of the Brain, London, 1876, p. 184) tend to show that the olfactory centre is situated at the tip of the temporo-sphenoidal lobe—the faradization of this spot in animals being followed by a sniff, which is evidently the outward expression of the excitation of the centre. Not only does destruction of this part seem to cause loss of smell, but it is observed to be much developed in animals which have a keen sense of smell. Injury of the external olfactory tract, which is lost in the island of Reil, has been shown by Serres (Anat. Comp. du Cerveau, t. i., p. 295), in nineteen post-mortem examinations of paralytic patients, to be associated with loss of smell in a much more marked manner than injury of the internal tract.

[5] Brit. Med. Journ., April, 1861.

[6] Lond. Hosp. Rep., vol. i., p. 10.

[7] Loc. cit., p. 273 et seq.

[8] Dict. Encyclop. des Sci. Med., Paris, 1873, t. xiv., p. 456.

the pressure of tumors in the brain, it is remarkable that abscess in the cerebral substance very seldom interferes with the function of the olfactory centre, for out of 89 cases of this affection collected by Ball and Krishaber,[1] in 38 of which the left side of the brain was affected, anosmia was not present in a single instance. In connection with aphasia, it must not be forgotten that anosmia, unless specially looked for, would be very likely to escape notice. The fact that the loss of smell in these cases is only unilateral would probably prevent the patient noticing it, but even were it to be observed by him, his limited powers of articulate expression would probably prevent his calling attention to it. In connection with this subject, it may be mentioned that Hughlings-Jackson[2] has shown that plugging of the anterior cerebral, or possibly of the middle cerebral artery, sometimes gives rise to anosmia.

Prévost[3] has reported 14 cases in which he had examined the olfactory nerves after death. In 6 of these the sense of smell had not been tested during life, and no conclusion, therefore, can be drawn from the observations. In 4 others, in which it had been absent or deficient for some time before death, there was found distinct degeneration of the nerve-tissue of the olfactory bulbs. In the remaining 4 cases, however, similar pathological changes were discovered in the nerves, although the sense of smell had been proved during life to be perfectly sound.

Congenital absence of the olfactory nerves has been observed by Bonet,[4] Rosenmüller,[5] and Pressat.[6] In Pressat's case, at the post-mortem examination of a patient who during life never had any sense of smell, it was found that there was complete absence of the olfactory nerves, and not even a trace of the bulb or roots could be discovered. The brain in the immediate neighborhood was quite healthy, and no other nerves were wanting. On the left of the crista galli there was a groove, but on the right side there was no trace of this. The ethmoid did not present the usual perforations, there being only a single small aperture on the left side near the ethmoidal fissure, where the nasal branch of the fifth nerve passed through. There was no alteration of any kind affecting the pituitary membrane. The case related by Bonet is somewhat analogous in character, and it possesses additional interest as being quoted from Schneider. In this instance the patient was a young man who had suffered from congenital anosmia, and it was found after death that the olfactory nerves did not send any branches to the pituitary membrane. The same author records a second case,[7] in which, in the case of a man who had no smell, the olfactory nerves were absent.

Diagnosis.—It is very important to differentiate the various forms of anosmia. Mechanical obstructions can be easily recognized with the help of the speculum and mirror, and in most of the cases of a neurotic character there are associated symptoms which point to the real nature of the affection. In all cases where the patient complains of impairment of smell, the function should be tested by first closing one nostril, and then the other, when it will at once be ascertained whether the sense is destroyed on one side, or blunted on both; and it should be remembered that in loss of smell dependent on injury to the seventh or fifth nerves the affection is almost always unilateral.

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[1] Op. cit. [2] Lond. Hosp. Reports, 1864, vol. i., p. 410.
[3] Gaz. Méd., September 15, 1866, No. 37, p. 597 et seq.
[4] Sepulchretum, Genevæ, 1700, lib. i., sect. xx., obs. 2.
[5] De Defectu Nervi Olfactorii. Leipzig, 1817. [6] Op. cit.
[7] Op. cit., lib. i., sect. xx., obs. 3.

In testing the smell the patient should not be allowed to know what scent is presented to his nostrils, but at the same time it is important that the test-odors should be familiar. Oil of cinnamon, oil of peppermint, turpentine, valerian, or a well-used tobacco-pipe will be found to serve the purpose well.

Prognosis.—The prospect of restoration of function depends, of course, on the nature of the lesion. Where there is cerebral disease the sense of smell is seldom recovered. Notta [1] has pointed out that, strange as at first sight it may appear, in anosmia resulting from injury of the head the sense of smell is more often restored when the associated lesions have been severe—that is to say, when there has probably been fracture of the base of the skull—than when the accident has apparently been less violent. The explanation is to be found in the fact that anosmia following a comparatively slight injury is likely to be due to separation from the brain of the olfactory bulbs, a condition which, of course, is irreparable.

Where anosmia is dependent on catarrh, a favorable prognosis may be given, but I have never known recovery to take place in such cases where loss of smell has existed for two years or more. Where, however, the loss of smell is simply the result of mechanical interference with the conditions necessary for the proper exercise of the function, as in the case of polypi and other growths, the sense, in most cases, will be restored when the obstruction is removed, even after a lapse of many years. Bauer [2] has reported a case which came under his own notice, in which a man who had lost his smell for fifteen years suddenly recovered it after a voyage. The cause of the anosmia is not stated.

Treatment.—In true anosmia—that is to say, in loss of smell dependent on loss of nerve-power—no treatment has hitherto proved of any avail. In cases of cerebral injury or disease, or when the continuity of the nerve is interrupted, it is obvious also that nothing can be done. Where the function of the nerve is merely blunted, however, benefit may be looked for from therapeutical measures. Beard and Rockwell [3] have met with success from galvanism, applied both inside and outside the nose; but though I have employed this treatment in favorable cases, such as loss of smell after prolonged catarrh, I have never found it do any good. Althaus [4] has found that a very powerful current is required to stimulate the olfactory nerve, no less than thirty-five plates being necessary to obtain any response. This, by affecting the contiguous nerves, causes extreme pain, dazzling flashes of light, a hissing noise like that of a steam-engine, together with faintness and giddiness—a condition which is really worse than the original complaint. Hence this treatment cannot be recommended. The insufflation of a powder containing one-twenty-fourth of a grain of strychnia with two grains of starch, twice a day, will sometimes do good. If no effect is produced, the strychnia may be increased to one-sixteenth or one-twelfth of a grain. This remedy, which was originally recommended by Althaus,[5] has twice proved of service in my hands. Should the anosmia be intermittent, quinine should, of course, be given, as in the case reported by Maurice Raynaud.[6]

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[1] Loc. cit.

[2] De Odoratu Abolito, Altorfii Noricorum, 1751, p. 192.

[3] Practical Treatise on the Med. and Surg. Uses of Electricity, London, 1881, third edition, pp. 646, 647.

[4] Lancet, 1881, vol. i., p. 772.

[5] Ibid., p. 815.

[6] Loc. cit.

PAROSMIA.

The subjective perception of a disagreeable odor is not very uncommon. It is often a species of epileptic *aura*, and this doubtless results, as Althaus [1] remarks, in certain cases from disturbances in the olfactory centre, and subsequent extension of the morbid impression to the motor centres. Parosmia is often met with in lunatics, although in them, as Schlaeger [2] has pointed out, the apparent hallucination often really depends on a lesion involving the olfactory centre. A case reported by Lockemann [3] furnishes a good illustration of this condition. The patient was a woman aged fifty-five, who, after suffering from giddiness and epilepsy for a year began to notice that immediately before a seizure she experienced sensations of "indescribable" smells, which were sometimes agreeable in character, and which ceased when the fit was over. This symptom gradually disappeared in the course of a few months, and, till the death of the patient from coma two years later, nothing peculiar as regards the sense of smell was observed. The autopsy revealed a carcinomatous tumor about the size of a duck's egg in the left cerebral lobe. This growth had destroyed every vestige of the left olfactory tract. There can be no doubt that toward the end of her life this patient suffered from unilateral anosmia, although the symptoms escaped observation. In a somewhat similar case related by Sander,[4] a man aged thirty-three was subject to epileptic fits, which were ushered in by an excessively disagreeable smell. Symptoms of insanity came on after a time, and before death the patient became totally blind. The post-mortem examination showed that a glioma of the size of an apple was situated on the under surface of the left temporal lobe, extending into its substance for a depth of two inches and a half. The growth also reached the under part of the frontal lobe, and the posterior part of the left olfactory tract was lost in it. It is not clearly stated whether the parosmia occurred only in the first attacks, or whether it was a constant precursor, as in Lockemann's patient above mentioned. A case was recorded by Whytt,[5] which has been often referred to by subsequent writers. The subject was a boy aged ten, who, *between* attacks of hystero-epilepsy, used to complain of a peculiar smell; but as the lad had at the same time a purulent discharge from the nose, I do not think the case deserves the consideration it has received. Westphal [6] has reported a much more pertinent example of parosmia, which occurred in a syphilitic patient who suffered from convulsions. In this instance, at the autopsy, the olfactory bulb was found "adherent," and near it were seen two small gummata on the pia mater. In the case of a lunatic, related by Schlaeger, the patient had complained of disagreeable smells for many years, and after death a fungous tumor of the dura mater was found on the cribriform plate of the ethmoid. A patient referred to by Hughlings-Jackson [7] used to be troubled with the smells as the epileptic fit was passing off.

Perversion of the sense of smell, however, is not uncommonly met

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[1] Lancet, 1881, vol. i., p. 814.
[2] Zeitschr. d. Gesellschaft. d. Aerzte zu Wien, 1858, Nos. 19 and 20.
[3] Zeitschr. f. rat Med., 1861, 3 Reihe, xii.
[4] Archiv f. Psychiatrie, 1873–74, Bd. iv., p. 234 et seq.
[5] Observations on the Nature, Causes, and Cure of thoae Disorders which have been commonly called Nervous, Edinburgh, 1765, p. 144 et seq.
[6] Allgem. Zeitschr. f. Psychiatrie, Bd. xx., p. 485.
[7] Lancet, January 24, 1866.

with in persons in whom there is not the slightest evidence of disease of the nervous centres. Sometimes the disagreeable smell is constantly present, but in other instances it is provoked by substances the odor of which is generally considered to be agreeable, or at any rate indifferent. In a patient recently under the care of Sir William Jenner and myself the smell of cooked meat was so exactly like that of stinking fish that scarcely any animal food could be taken. The patient was a lady of about fifty years of age, in whom the menstrual function still continued active. She was a person of remarkable vigor, both of body and of mind, fond of out-door exercise, and never having shown the least sign of hysteria. She was under treatment for several months. After a time the digestion became upset, and the function of the liver was somewhat disturbed; but these symptoms appeared to depend on the patient's inability to take proper food, and were the result rather than the cause of the parosmia. Every kind of local and constitutional treatment was tried. After some months complete recovery took place, but I could not attribute it in any way to the remedies.

In persons otherwise perfectly healthy, permanent abnormalities in the sense of smell may sometimes be observed. Thus a leading member of our profession has informed me that violets always smell to him exactly like phosphorus, and I know of another person to whom mignonette has the odor of garlic. It is not improbable that an affection of the olfactory sense, analogous to color-blindness, may occasionally exist.

Anomalies in the function of smell are probably sometimes due to inflammatory changes in the olfactory nerve itself, or to conditions corresponding to neuralgia in a nerve of common sensation. A very remarkable example was published several years ago by Robertson,[1] in which the patient, a woman, aged fifty, a week after the removal of a cataract from her right eye, began to suffer from inflammation of the iris and choroid. This was followed by subjective sensations of smell of the most disgusting nature, a symptom which was at once relieved by a hypodermic injection of morphia. An instance has been related by Althaus,[2] in which a patient, after exposure to cold, was startled by perceiving a strong smell of phosphorus, which overpowered all other accidental smells, and never left him for six weeks. At the end of that time he noticed that he had become insensible to odors of any kind, though the function of the fifth nerve was still quite unimpaired. Symptoms of locomotor ataxy gradually came on, and the patient died eight years after the commencement of his illness. The olfactory lobes showed the naked-eye appearances of neuritis, but through an unfortunate accident they were not submitted to microscopic examination.

No rules can be laid down for *treatment*, the great variety of the diseased conditions giving rise to parosmia making it necessary to adopt different measures according to the circumstances of the case.

DISEASE OF THE FIFTH NERVE, OR ITS NASAL BRANCHES.

When the fifth nerve or its nasal branches are injured or diseased, the mucous membrane of the nasal fossæ loses its sensibility. Under such circumstances a pungent vapor, such as ammonia or ether, is not perceived, and does not give rise to the reflex phenomenon of sneezing. On the other

[1] Boston Med. and Surg. Journ., 1873, vol. lxxxix., p. 280.
[2] Lancet, 1881, vol. i., p. 814.

hand, when these nerves are subjected to abnormal irritation, excessive sneezing may take place. In ordinary catarrh there is no doubt that irritation of the branches of the fifth nerve occurs, and that the hyper-secretion taking place is the effect of vasomotor paralysis. A really typical example of the affection, however, has been related by Althaus,[1] in which the complaint was purely neurotic in character.

The *treatment* of conditions, the cause of which is so obscure, is not very hopeful. In the case of deficient sensibility, however, some good may possibly be done by frequent mild applications of the galvanic current directly to the mucous membrane. The therapeutics of catarrh have been already fully discussed (p. 202 et seq.), while for nervous sneezing, I can only suggest large doses of bromide of potassium, combined in some cases with insufflations of morphia.

CONGENITAL DEFORMITIES OF THE NOSE.

Latin Eq.—Deformitates nasi ingenitæ.
French Eq.—Vices de conformation du nez.
German Eq.—Missbildungen der Nase.
Italian Eq.—Vizi di conformazione del naso.

Definition.—Congenital deviation from the normal shape of the nose, consisting in the absence or reduplication of the whole organ, or any of its constituent parts, or in complete or partial closure of its canals.

History.[2]—The only case on record, so far as I am aware, of complete absence of the nose, is one reported by Maisonneuve.[3] The patient was a girl, who, when first seen by that surgeon, at the age of seven months, presented the following anomaly: The nose was represented by a flat surface pierced only by two round holes, each being scarcely one millimetre in diameter. These apertures were 3 ctm. apart. It is not stated whether the internal structures of the nose were normal, or whether there was any coexisting deformity of any other part of the body.

The septum is sometimes altogether wanting. An instance of complete absence of this partition in a still-born fœtus was published by Fernet[4] in 1864. In this case the floor of the nose was also partly deficient, the palate being cleft in its whole length. There was besides double harelip, and the eyeballs and optic nerves were absent. The posterior lobes of the brain were atrophied, and each hand and foot had six digits. The septum occasionally presents a deficiency of substance in one spot, so that the two nasal fossæ communicate through a congenital aperture; cases of this kind have been recorded by Portal,[5] Hildebrandt,[6] and Hyrtl,[7] who states that he has met with the abnormality three times in the course of his "anatomical life." Zuckerkandl,[8] however, who says that he found a hole in the cartilaginous part of the septum eight times in

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[1] Med.-Chir. Trans., 1869, vol. lii., p. 27 et seq.

[2] In dealing with the history of the subject, the bibliography has not been treated in the usual chronological method, but the few scattered cases on record have been reproduced in the order in which they are referred to in the *Definition*.

[3] Bull. Gén. de Thérapeutique, 1855, t. xlix., p. 559.

[4] Bull de la Soc. Anat., 1864, 2e série, t. 9, p. 130.

[5] Cours d'Anat. Médicale, Paris, 1804, t. iv., p. 481.

[6] Lehrbuch der Anatomie des Menschen, Wien, 1802, vol. iii., p. 162, § 1647, footnote. This writer, who was Professor of Anatomy at Göttingen, states that he himself had a congenital hole in the cartilaginous part of his septum large enough to admit a pea.

[7] Lehrbuch der Anatomie des Menschen, Wien, 1882, pp. 576, 577.

[8] Normale und pathol. Anatomie der Nasenhöhle, Wien, 1882, pp. 99, 100.

one hundred and fifty bodies, holds that the opening is not caused by arrest of development, but is really a loss of substance due to previous perichondritis.

A remarkable example of congenital deformity of the nose was reported by Thomas,[1] in 1873. The patient was a boy three months old, born of healthy parents who had previously had several perfectly formed children. On the right side of the face there was a triangular opening with a somewhat rounded base, which corresponded to the anterior orifice of the nasal fossa, the apex reaching beyond the inner angle of the eye almost to the upper border of the orbit. The cavity of the right fossa was thus exposed as high as the root of the nose. The opening was bounded *externally* by the integuments of the cheek and eyelids, which were continuous with the nasal mucous membrane. *internally* and *above* by the skin of the nose, which also was continuous with the mucous membrane at the edge of the cleft, while lower down the opening was bounded on its inner side by the mucous membrane of the right *ala nasi*, which was turned inward and upward. Through the fissure could be seen the lower spongy bone, the upper and inner part of which was adherent to the internal surface of the everted ala. The right eye and orbit were normal, but the inner extremity of the lower eyelid with the *caruncula lachrymalis* was half a centimetre lower in level than the corresponding part on the left side. As the upper eyelid was normal in direction, there was thus a gap between the right eyelids at the inner canthus of more than a centimetre in width. This gap was bridged over by a strip of skin about three millimetres wide, which separated the eye from the nasal fissure. Along the middle line of the nose there was a raphé projecting to the extent of about one millimetre, which seemed to mark the line of union of parts originally separate. There was no deformity in any other region of the body. In 1859 Hoppe[2] reported a case of congenital malformation of the nose, in which there was a furrow along the middle line, the nasal bones being entirely absent. Their place was occupied by two cylindrical pieces of cartilage, and a fissure existed along the middle of the nose from the root to the tip, where there were two round knobs. The nostrils were well formed and properly separated.

Quite recently, Lefferts[3] has described a case of double septum in a man aged twenty-five. The upper half of the posterior edge of the partition was divided in the vertical direction into two distinct portions, which were separated widely enough to admit the end of a lead-pencil between them. The space thus enclosed was triangular in shape, the widest part being above, and the mucous membrane covering it had a natural appearance.

A case of double nose was related by Borelli,[4] but without sufficient anatomical details to establish the true character of the malformation. Although many of the cases reported by the earlier medical writers are undoubtedly fabulous, still a positive statement of fact by so celebrated a man is not to be too lightly dismissed. It is obvious, however, that a vague expression like *nasus duplex* might refer to a lipomatous tumor or elephantiasis, as well as to a veritable double organ.

Cases of congenital occlusion of the posterior nares have been reported by Emmert,[5] Luschka,[6] Voltolini,[7] Betts,[8] Cohen,[9] and Ronaldson.[10] In Emmert's patient, a boy aged seven, there was complete bony obstruction of both choanæ. Luschka's case occurred in a female child, and the openings were also closed by bone. Thin osseous laminæ extended from the horizontal plate of the palate-bone to the inferior surface of the sphenoid, to which they were united by a dentated suture. In Voltolini's case only the right choana was closed, the atresia being due to "congenital adhesions." Betts found both posterior nares closed by bony partitions in a fœtus seven months old. In Cohen's case the nature of the occlusion is not stated, but it was probably membranous. The example related by Ronaldson occurred in a female child, born at full time and presenting no other malformation, who died very soon after birth, from inability to breathe through the nostrils. The posterior nares were found to be completely occluded by a thick membrane of such firm texture that a probe could hardly be forced through it.

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[1] Bull. de la Soc. de Chir., 1873, 3e série, t. ii., p. 162.
[2] Med. Zeitung des Ver. f. Heilk. in Preussen, 1859, p. 164.
[3] Philadelphia Medical News, January 7, 1882.
[4] Obs. Rarior. Medico-Phys., cent. iii., obs. 43.
[5] Lehrb. d. Chirurgie, Stuttgart, 1853, Bd. ii., p. 355.
[6] Schlundkopf der Menschen, 1868, p. 27.
[7] Die Anwendung d. Galvanokaustik, Wien, 1870, second edition, pp. 240–262.
[8] New York Med. Journ., July, 1877, p. 97.
[9] Diseases of the Throat and Nasal Passages. New York, 1879, second edition, p. 385. To Cohen I am indebted for most of the references relating to this malformation.
[10] Edin. Med. Journ., 1880–81, p. 1035 (May, 1881).

Harrison Allen [1] has lately called attention to an occasional irregularity in the relative size of the nasal fossæ, caused not by deviation of the septum, but in congenital narrowness of one chamber as compared with the other.

Etiology.—The causes of such anomalous formations are probably the same as those which determine imperfect or abnormal development of other organs. The principal theories on this obscure subject have already been discussed in a previous article (see Malformations of the Gullet, p. 152 et seq.), and need not be further referred to in this place. With regard to the unequal capacity of the nasal chambers, Allen states that he has observed it chiefly in idiots, and he suggests a possible cause for it in the irregular depth of the depressions in the base of the skull, owing to unequal development in different parts of the brain. I may say, however, that in none of the skulls in the Museum of the College of Surgeons was I able to detect any inequality in the size of the nasal fossæ not dependent on the position of the septum.

Symptoms.—In the cases of deficiency of a portion of the nose mentioned in the above short historical retrospect, no symptom was noticed beyond the disfigurement arising from the malformation. Where there is atresia of the posterior nares, the child's breathing is difficult, and the serious troubles attending obstruction ensue (see p. 204).

Prognosis.—None of the deformities described can be said to threaten life except congenital closure of the posterior nares, and that only in infancy.

Treatment.—Various plastic operations may be undertaken for the correction of these deformities. Maisonneuve, who claims that his case is the first instance on record of rhinoplasty for congenital malformation, has given such an incomplete description of the procedure which he adopted that it is useless to reproduce it; and I can find no statement of the ultimate result of the procedure, either as to the appearance of the organ, or as to its functional utility.

In the case of fissure exposing one nasal fossa up to the root of the nose, Thomas made an incision along the inner edge of the cleft at the junction of the skin with the mucous membrane. He then dissected up the skin, beginning at the narrow strip between the eyelids, which, moreover, he detached by a cross-cut from its union with the upper eyelid. The outer edge of the fissure was then pared, and an incision was carried vertically up the brow from the apex of the fissure. From the upper end of this cut another was carried horizontally toward the other side for about one centimetre, the object being to loosen the integuments on the brow. The ala was next separated from the inferior turbinated bone, to which it was adherent. The integuments of the nose having been dissected up toward the middle line, the parts were made sufficiently movable to enable the operator to bring the ala over into contact with the outer edge of the fissure without using undue violence. The surfaces thus brought into apposition were fixed together by a pin passed through the upper lip and the ala, while a suture held the cheek and the inner edge of the fissure in position. The narrow strip of skin between the eyelids, which had been separated from the upper eyelid, was then drawn up with forceps, and inserted between the edges of the vertical incision previously described, being fastened to its new connections by sutures on each side. Finally, the upper angle of the original fissure was closed by a suture passed through

[1] Philadelphia Medical News, May 26, 1883, pp. 605, 606.

its borders just under the lower eyelid. The sutures were removed in four days, when it was found that the ala was firmly united to the outer edge of the nostril, but there was no union at the upper part, a circumstance which Thomas attributed to the somewhat rough usage which the small transplanted flap had received in the course of the dissection necessary to loosen it. In a fortnight the lower part of the nose was almost normal in appearance, but the lower eyelid was still too widely apart from its fellow at the inner canthus, and a fissure from two to three millimetres in width remained between the inner angle of the right eye and the nose. The patient was then unfortunately lost sight of, and nothing seems to be known as to the ultimate result of the case; but, as Thomas remarks, a decided improvement in appearance had so far been achieved, and a subsequent operation for the purpose of remedying the remaining defects would have been much less difficult and severe.

In cases of congenital occlusion of the posterior nares, treatment is imperatively called for, and no time should be lost in carrying it out. A passage must be forced through the obstructing membrane with a strong probe, as in Ronaldson's case, or with the galvanic cautery, as was done by Voltolini, and the opening should be gradually dilated and kept open by the passage of bougies. Tracheotomy is advised by Ronaldson, but this measure would only be justifiable as a last resource.

Congenital deficiency of the olfactory bulbs has already been described under the head of Anosmia (p. 325).

Synechiæ of the Nasal Fossæ.

Under this term Zuckerkandl[1] has described certain anomalous conditions which may be briefly referred to here. As the name implies, these consist of connecting bands of tissue between particular portions of the interior of the nose which are normally separate. The junction is sometimes made merely by continuity of the investing membrane, and sometimes by true bony union. Four chief varieties of "synechia" appear to occur: (1) membranous bridges spanning the interval between two opposite surfaces —*e.g.*, between the middle turbinated body and the septum; (2) broad membranous junctions between the mucous covering of one of the turbinated bodies and that of the outer wall of the nasal fossa, or between the corresponding angles of neighboring turbinated bodies; (3) *osseous* bridges connecting one of the turbinated bones with the septum; (4) wide bony union between the edge of the lower turbinated bone and the floor of the nose. It must be understood that all these varieties or any number of them may coexist, and that any one of them may be found in several places. In one case Zuckerkandl found synechiæ between the lower turbinated body and the floor of the nose, between the middle turbinated body and the septum, and again between the same body and the outer wall. In 2,152 skulls examined in the Museum of the College of Surgeons I met with but 4 instances of bony synechia. In one, the lower turbinated bone was greatly enlarged and adhered to the septum. In a second, in which the septum was deviated to the left, two thick osseous bands, not connected together, ran across from the convexity of the deflected part to join the lower turbinated bone and the portion of the outer wall above it. In a third case, in which there was no septal deviation,

[1] Anatomie der Nasenhöhle, Wien, 1882, p. 95 et seq.

there were two bony plates bridging over the space between the left side of the septum and the corresponding outer wall; one was narrow and ran horizontally across from the middle of the septum to the upper part of the lower turbinated bone, while the other crossed from the lower edge of the middle turbinated bone to join the septum by an attachment one-third of an inch in width, and sloping slightly upward from behind forward along the septum. In the fourth instance the edge of the vomer projected somewhat into the right nasal fossa and from the lower edge of the ridge thus formed an osteo-cartilaginous plate extended horizontally across to the under edge of the lower turbinated bone; this plate ran backward in the nasal fossa for about an inch, and converted the inferior meatus into a covered way.

I have also recently seen a patient in whose case a firm membranous band, covered with mucous membrane, passed across the cavity of the right nasal fossa from the lower turbinated bone to the septum.

Synechiæ are occasionally symmetrical, being present in both nasal fossæ in corresponding situations. It is probable that the condition is nearly always congenital, though it is, of course, possible that it may in certain cases be due to morbid outgrowths followed by ulceration and subsequent adhesion of adjacent parts. This latter view is, perhaps, somewhat confirmed by the fact that synechiæ have been found associated with perforation of the septum.

The condition is in most cases little more than a pathological curiosity. In the example referred to above, which came under my own notice, the patient experienced great difficulty in blowing his nose on the affected side. Should treatment seem desirable, any abnormal piece of bone may be removed by dividing both its attachments with my nasal bone-forceps (Fig. 55, p. 187); or, in the membranous cases, a cure may be effected by means of the galvano-caustic loop. Even osseous bands, when slender, may be got rid of by this method; a case having been reported by Brandeis [1] in which a transverse bony synechia, that caused obstruction of the nasal canal, was removed with the electric cautery.

[1] New York Med. Record, November 12, 1881.

SECTION VI.—DISEASES OF THE NASO-PHARYNX.

THE anatomy of the naso-pharynx has already been given in the first volume of this work, while the instruments required for the examination and treatment of this part have been described under Nasal Instruments. It only remains, therefore, to consider the few but very important diseases which occur in the post-nasal region.

CHRONIC[1] CATARRH OF THE NASO-PHARYNX.

(SYNONYMS: POST-NASAL CATARRH. RETRO-NASAL CATARRH. FOLLICULAR DISEASE OF THE NASO-PHARYNGEAL SPACE. AMERICAN CATARRH.[2])

Latin Eq.—Catarrhus longus pharyngis nasalis.
French Eq.—Catarrhe chronique du pharynx nasal.
German Eq.—Chronischer Catarrh des Nasenrachenraumes.
Italian Eq.—Catarro cronico della faringe nasale.

Definition—Chronic inflammation of the lining membrane of the naso-pharynx, giving rise to a more or less viscid secretion, the adhesion of which to the part causes a most disagreeable sensation, and induces the patient to make frequent efforts to get rid of it by "hawking" and "clearing the throat."

History.—The disease was first described by J. P. Frank[3] as a form of chronic catarrh the seat of which is the pharynx. Many years later a detailed account of the affection was given by Dobell.[4] The complaint has been familiar to all those who study throat-diseases from the time of the invention of the laryngoscope; and since I commenced teaching at the Throat Hospital, in 1863, I have constantly called the attention of students to the various features of this important malady. In 1874 Wendt[5] described both the moist and the dry forms of the affection in considerable detail. Lennox Browne[6] in 1878 gave a description of the disease in connection with nasal catarrh and

[1] As acute catarrh of the naso-pharynx either rapidly disappears or passes into the chronic form of the disease, it has not been thought necessary to treat it separately.

[2] The complaint is so extraordinarily prevalent in America, as compared with any other country, that it may be regarded with all propriety as a national affection.

[3] De Curand. Homin. Morbis, lib. v., pars i., pp. 124, 125. Mannhemii, 1794.

[4] Winter Cough, London, 1866, first edition, appendix, p. 172 et seq. Dr. Dobell states that he had already called the attention of the profession to the subject of "post-nasal catarrh" in a paper read before the Abernethian Society of St. Bartholomew's Hospital in 1854.

[5] Ziemssen's Handbuch, Leipzig, 1874, Bd. vii., erste Hälfte.

[6] The Throat and its Diseases, London, 1878, p. 153 et seq.

ozæna. Two years later, Beverley Robinson, of New York, published a work on catarrh, in which, under the title of "Follicular Disease of the Naso-pharyngeal Space,"[1] he gave a very complete account of the complaint. Since then the disorder has been incidentally referred to by Woakes,[2] Rumbold,[3] Bosworth,[4] and by every writer on nasal catarrh. The latest contributor to the literature of the subject is Bresgen,[5] who has recently brought together the views of nearly all preceding writers on this matter.

Etiology.—The causes of catarrh in general have been frequently discussed in this work, but for my views on the subject, I would refer especially to the remarks made in connection with acute catarrh of the larynx (vol. i., p. 195). The affection is exceedingly common in America; indeed so much is this the case that the term "catarrh," as commonly used in America, means post-nasal catarrh—*i.e.*, catarrh of the naso-pharynx. It is possible that a review of the conditions under which post-nasal catarrh exists in America may throw some light on the etiology of the complaint. Unfortunately, however, up to the present, American physicians, though assiduously studying the therapeutics of the disease, have given little attention to its causes. Indeed, the only practitioner who appears to have seriously investigated this subject is Beverley Robinson,[6] who, in a thoughtful and suggestive work, remarks:

"In New York, Boston, and Philadelphia, in many of our Western cities, on the seashore, and in the interior, in fact, over widely extended and very different sections of our country, post-nasal catarrh prevails to an extent which originates much inquiry, and occasions more than passing anxiety to those who have observed its course. Vast numbers of people are already affected with it. Men, women, and children are alike its prey. All ages and professions are subjected to its symptoms and complications. Moderate differences or changes of climate only partially affect its growth; for while in individual instances its onward and rapidly progressive march appears to be somewhat delayed, if not completely arrested, by breathing a high, equable, and dry atmosphere, or by the respiration of air impregnated with balsamic odors, other and numerous examples there are when once the catarrhal affection has become firmly seated, but little influenced for the better by the most rational hygiene and an ambient medium seemingly the most perfectly adapted to their individual needs. Usually, speaking, however, a cold damp atmosphere, subject to sudden and great changes of temperature, is supposed to be a general and efficient, if not exclusive, cause of the production and extension of post-nasal catarrh. No doubt this accepted belief has some basis in fact; and yet the more closely I have been able to investigate the subject in its multiple aspects, the more thoroughly am I persuaded that the received opinion is in part erroneous. The development of the malady is not much affected by habit or occupations, and strong and weak organizations are similarly attacked. No constitution is entirely exempt, but certain persons are more disposed to contract it than others."

Though I would not for a moment place my experience of American

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[1] Practical Treatise on Nasal Catarrh, New York, 1880, p. 117 et seq.

[2] Deafness, Giddiness, and Noises in the Head, London, 1880, second edition, p. 178 et seq.

[3] Hygiene and Treatment of Catarrh, St. Louis, 1881, part ii., p. 237 et seq.

[4] Manual of Diseases of the Throat and Nose, New York, 1881, p. 179 et seq.

[5] Der chronische Nasen und Rachen-Katarrh, Wien und Leipzig, 1883, p. 41 et seq.

[6] Nasal Catarrh, New York, 1880. See the article on Follicular Disease of the Naso-pharyngeal Space (Post-nasal Catarrh).

catarrh on a level with that of any of the eminent specialists who have given attention to the subject in the United States, I may remark that in a recent tour through that country I had a very favorable opportunity of studying the complaint. For I not only saw examples of the disease over a very wide tract of country, but also observed the atmospheric conditions under which these cases occurred, enjoying, moreover, the great advantage, in many localities, of discussing the subject and hearing the views of able physicians who had been studying the disorder on the spot for many years. I was greatly astonished at the extremely wide diffusion of the affection. I met with it all over the Eastern States, it was very common in Chicago and St. Louis, which may now be called the central cities of America, I found it prevalent in Nebraska and to a slighter extent in Utah, and again I encountered it on the Pacific coast, finding it of frequent occurrence in San Francisco. I had not the opportunity of seeing any patients in Nevada, as I merely travelled through that State without stopping; but in London I have treated many American travellers for post-nasal catarrh who had acquired the disease on the alkaline plains of the Silver State. I also saw a good many patients suffering from catarrh of the naso-pharynx in Colorado. In Southern California and Arizona I scarcely met with any cases, and in Canada the affection, though much more common than in Europe, did not seem to be so universal as in the States. American catarrh, it would seem, principally prevails between latitudes 44 and 38.

My travels in America were made in the latter end of August and in September and October—that is, during the most favorable season of the year; and I have little doubt that had I been there in the winter I should have seen a great deal more of this wide-spread ailment. In many of the regions referred to there are local conditions which tend to irritate the mucous membrane. Thus, all along the eastern seaboard the atmosphere during the winter months is cold and moist, while in the summer it is excessively hot. In San Francisco fogs prevail in the summer in the early part of the day, while in the afternoon a cutting wind blows continuously. In Colorado, on the other hand, the climate is so extraordinarily dry that only those who have been there can thoroughly appreciate it. The inhabited portion of the country consists of extensive plains situated at an elevation of 5,000 or 6,000 feet above the level of the sea. The dryness of the climate may be gathered from the fact that not a drop of rain falls during nine months of the year, the result being that no trees can flourish, the scrub oak being almost the sole representative[1] of our forest trees, and this being only found in the narrow valleys or cañons, as they are called. Indeed, so dry is the soil, that not unfrequently all the prairie grass perishes. The atmospheric conditions, though admirably suited for some forms of consumption, are nevertheless extremely irritating to the mucous membrane of many persons. The white alkaline dust which covers hundreds of miles in Nevada is also met with here and there in Colorado. In the winter and spring the winds are often rather strong, and it will easily be imagined that at such times the abundant dust of this extraordinarily dry country is very irritating.

The soil of the American continent varies so widely in different parts that it is impossible to suppose that it is concerned in the etiology of the

[1] The cotton tree, though indigenous in certain parts of South America, appears to be an exotic in Colorado, and I only saw it as an ornamental tree in the streets and gardens of some of the cities.

affection. Again it will be readily understood that the meteorological conditions over this vast area are so various that they cannot be regarded as a cause acting with anything like uniformity. The general character of the atmosphere of the American continent, as compared with that of Great Britain, and also with most parts of Europe, is that it is drier, that the changes of temperature are more sudden, and the extremes of heat and cold much greater. There is nothing, however, in these conditions to account for the localization of the complaint in the naso-pharynx, and it would seem that post-nasal catarrh is not due to what may be strictly called climatic influence, but to something which is accidentally introduced into the atmosphere of widely differing localities; in other words, that there must be irritant particles floating in the air over very wide areas. This is actually the case, for *dust* is to be found everywhere in America.

The universal prevalence of catarrh is indeed fully explained by the abundance of dust, both in the country and the cities. Owing to the immense size of the country, and its sparse rural population, the country roads have not, as a rule, been properly made, and except in some of the older States are merely the original prairie tracks. In the cities, notwithstanding the magnificence of the public buildings, the splendor of many of the private houses, and the beauty of the parks, the pavement is generally worse than it is in the most neglected cities of Europe, such, indeed, as are only to be found in Spain or Turkey. It must be recollected also that while in the decayed towns of the Old World there is very little movement, in the American cities there is a ceaseless activity and an abundance of traffic. Hence, the dust is set in motion in the one case, but not in the other. The character of the dust, of course, varies greatly according to locality. In some parts it is a fine sand, in others an alkaline powder, while in the cities it is made up of every conceivable abomination, among which, however, decomposing animal and vegetable matters are not the least irritating elements. An idea may, perhaps, be formed of the state of the atmosphere from a consideration of the fact that in many cities the functions of the scavenger are quite unknown.

That a dusty atmosphere is the real cause of post-nasal catarrh is rendered probable by a consideration of the anatomical relations of the naso-pharynx. For owing to its being a cul-de-sac out of the direct line of the respiratory tract, particles of foreign matter which become accidentally lodged in its upper part are got rid of with difficulty—most likely by an increased secretion, which, as in the case of the conjunctiva, washes away any gritty substance which may temporarily alight on the membrane. In the larynx, irritating dust is dislodged by coughing, which may be either reflex or voluntary; and again, in the case of the nasal passages, the minute particles of matter which constitute dust are expelled, if they happen to be obnoxious, either by sneezing or blowing the nose. But reflex acts, such as coughing and sneezing, have no effect on the upper part of the naso-pharynx, and it is only by a voluntary effort, known as "hawking," that this cavity can be partially cleared. It is probable also that, owing to the sensibility of the naso-pharyngeal mucous membrane being less acute than that of either the nose or the larynx, minute foreign bodies accidentally lodged in the vault of the pharynx do not cause an amount of discomfort at all corresponding to that in the adjacent parts; hence particles of matter are more likely to remain *in situ* for a long time in the post-nasal region, than in either of the other parts, and are, of course, very apt to set up disease. In this country the complaint is most common in persons whose pharynx is large in the antero-posterior direction, a form of throat

which facilitates the entrance, without favoring the expulsion, of foreign particles. It will be readily understood that any morbid state of the posterior nares may lead to chronic inflammation, and thereby establish a catarrhal condition of the naso-pharyngeal region. In young subjects, adenoid growths are often a source of irritation. In such cases, however, the discharge which is set up does not tend to become adherent, as in true post-nasal catarrh, but flows away with comparatively little inconvenience. In fact, the catarrhal affection is altogether different from the idiopathic post-nasal catarrh which is met with in its typical form in America.

While, however, it is highly probable that dust is the most frequent cause of post-nasal catarrh, no doubt it is not the only one. Many circumstances favor its development. Thus I have noticed that in many cases the sufferers have been persons who partake largely of pungent condiments, and the habit (almost universal in America) of taking sauces and pickles with every dish may be concerned in the production of the disease. The national dyspepsia is also probably a most powerful factor, and a well-known American statesman tells me that he has known many cases cured by "abstemiousness and farinaceous diet." Some physicians have attributed the complaint to the custom of over-heating houses by hot air and steam, as is commonly done in America. In the winter the temperature is never allowed to fall below 70° Fahr., and is generally much higher. The sudden passage from this temperature to that of the street is not unlikely often to set up catarrh ; but as the same mode of heating is used in Russia without, as far as I am aware, giving rise to any post-nasal affection, its influence cannot be very great. The importance of heredity in the etiology of catarrh has been recently strongly insisted on by Bresgen,[1] and although no extensive series of exact observations has yet been made on this point, there is every probability that a disposition to catarrh may be inherited. I have seen so many instances, however, in which foreigners making a short stay in America have become affected with post-nasal catarrh, that I think there can be little doubt that atmospheric conditions—and those, let me add, of an accidental and controllable character—are much more powerful than heredity.

It is supposed by some that catarrh is contagious, but though the popular belief is strong on this point, there is very little scientific evidence in its favor. On this subject Beverley Robinson [2] asks—"How is it that a disease which is so prevalent in many sections of our country is certainly less known and familiar in England and on the Continent? Certainly, if the extensive propagation of this affection is merely a direct consequence of intimate contact, there would be just the same probabilities of the increase there as here." It is somewhat remarkable that at the present time, when germs are supposed to give rise to so many diseases, post-nasal catarrh has not been referred to this source, to which it may be remarked coryza has been attributed. Failing to discover any atmospheric cause for American catarrh, Beverley Robinson [3] suggests that "a special constitutional tendency exists in the individual." He observes that "post-nasal catarrh must not be confounded, as it almost universally is, with ordinary rhinitis. It is not simply an acute or chronic inflammatory condition of the pituitary membrane, nor should it, therefore, be treated in the same way ; for if it is, signal failure almost will follow our every effort. An acute or chronic coryza is, without doubt, a predisposing, and at times a proximate and *partially* efficient, cause of its becoming manifest. But in

[1] Op. cit., p. 41. [2] Op. cit. [3] Op. cit., p. 145.

order to effect the grafting of post-nasal catarrh, a certain diathetic condition is essential." He proposes to call this diathesis "catarrhal," and appears to think that there is some relation between it and the herpetic disposition. In putting forward an hypothesis which has no facts to support it, Robinson appears to have adopted the fallacies of the French School (see vol. i., p. 24, note 1). I entirely agree with him, however, that catarrh of the naso-pharynx very frequently commences in coryza; and, notwithstanding his views as to the "catarrhal diathesis," it would appear that he does not attempt to circumscribe the diathesis too closely, for in referring to this complaint he observes that, "while follicular disease is at times due to the catarrhal diathesis pure and simple, so it may be and frequently is attached to the gouty, herpetic, syphilitic, scrofulous, and tubercular. The malarial influence may likewise be evident. . . . ."

Lennox Browne [1] considers that the diathesis of patients suffering from catarrh of the naso-pharynx is "generally of a scrofulous character." Seeing, however, that the complaint is so very common in America, that it affects people of every temperament and constitution, and that it is readily acquired by visitors to the United States, it more probably depends on atmospheric conditions than on any diathesis.

Symptoms.—In slight cases the patient is troubled with a disagreeable sensation, as of something sticking in the upper part of the throat, which has to be frequently cleared away from the back of the nose. Distinctness in articulation is often interfered with. There is, in fact, a want of resonance or definition, more especially in the pronunciation of gutturals. This may be so slight as to be inappreciable by any one but the patient himself, who, if he is an educated person, and one who has to employ his voice in public, is almost sure to complain of it. When the disease is more severe the mucus is often extremely tenacious, and the patient has then to make the most violent and frequent efforts to "hawk" it from the naso-pharynx, a proceeding which is as dangerous to the patient as it is disgusting to those about him. The effort to get rid of the mucus is often accompanied by nausea, and in some cases by actual sickness. A very unpleasant sensation is constantly felt at the back of the throat, and in severe cases the patient experiences a dull aching feeling in the upper part of the throat, and occasionally weight or pain is complained of in the occipital region. On looking into the naso-pharynx moist yellowish white masses of mucus are seen *adhering* to the posterior wall and sides of the cavity. Post-nasal catarrh is often the cause of throat-deafness, and in some cases it gives rise to slight hemorrhage, which occasionally stains the patient's pillow, or occurs when he wakes in the morning; the source of the blood is apt to puzzle physicians who do not examine the naso-pharynx. The mucous membrane, after it has been cleansed with a spray or syringe, generally looks very red, but if a short time, say fifteen or twenty minutes, is allowed to elapse, much of the congestion, which is evidently due to the cleansing process, disappears. Raised red granulations can then be seen on the posterior wall and sides of the naso-pharynx. Sometimes they are small, oval or round in form, but, not unfrequently, those situated on the sides of the naso-pharynx are long and narrow, often from five millimetres to a centimetre and a half in length, and from three to five millimetres in width, but only slightly raised above the surface. In severe cases small erosions may be seen here and there, and occasionally ecchymotic spots. In young subjects adenoid growths are sometimes present, or there may be simple

[1] The Throat and its Diseases, London, 1878, p. 463.

enlargement of Luschka's tonsil. Congestion and swelling of the Eustachian orifices are often apparent, and now and then one or both of the openings are completely blocked up by adherent mucus. The oro-pharynx will generally be found more or less congested, and presenting in places a granular appearance. Varicose veins are also often visible on the posterior wall, while the pillars of the fauces are infiltrated or thickened.

Pathology.—The morbid changes which take place in the naso-pharyngeal region have not hitherto been studied on the dead subject, but no doubt they are identical with those which usually occur in catarrhal inflammations. As far as can be seen during life, the morbid process seems to be the same as has been described under the head of Hypertrophic Granular Pharyngitis (vol. i., pp. 26, 27).

Diagnosis.—Post-nasal catarrh is occasionally altogether overlooked by medical practitioners who are unacquainted with the affection, but those who have studied rhinoscopy are unlikely to make any mistake. When the patient is a young subject, catarrh of the naso-pharynx will sometimes be found to be due to adenoid growths; but, as already pointed out, the secretion differs altogether from that of true post-nasal catarrh. These formations, moreover, can generally be easily felt with the finger, and seen with the mirror. The possible presence of polypi should be borne in mind. Syphilis, likewise, both in its secondary and tertiary manifestations, may cause symptoms analogous to catarrh. If the naso-pharynx is well cleansed, however, condylomata or ulcers, if present, can usually be seen. In cases of tertiary disease, the administration of iodide of potassium will soon set the question of diagnosis at rest.

Prognosis.—The disease is not dangerous, but it is often a lasting inconvenience, and if it has existed for several years before it comes under observation, it is seldom cured; in recent cases, however, the complaint may occasionally be completely eradicated, and old-standing cases can, as a rule, be kept under control by judicious treatment.

Treatment.—This may be constitutional or local, or may combine both systems. Those who believe in the diathetic origin of the complaint naturally recommend internal remedies. Beverley Robinson[1] has found benefit from sulphur, cubebs, and ammoniacum; the sulphur may be given in the form of Harrogate waters; cubebs may be administered in a tincture with an equal part of tincture of orange to cover the taste; and ammoniacum may be prescribed in very small doses—one, two, or three grains—combined with ipecacuanha. Other writers have recommended cod-liver oil and phosphate of iron. Of course, in any case in which there is marked debility, tonics are likely to do good. In my experience, however, little benefit is, as a rule, derived from general remedies, while local treatment affords much relief. The first thing to do is to completely remove all the mucus from the naso-pharynx, or, in other words, to cleanse the parts thoroughly. If this can be accomplished by the use of sprays, it is the most advantageous method for the patient; but both anterior and posterior sprays are likely to be required. One of the best solutions is that introduced by Dobell (see Appendix), but if the carbolic acid is objectionable or irritating, the "compound alkaline wash" (see Appendix) may be substituted. If the secretion cannot be removed by spraying, the post-nasal syringe must be used; and if this again does not succeed, a medium-sized laryngeal brush should be employed. After the mucus has been got rid of, I have found most benefit from astringent insufflations. Of these,

[1] Op. cit., p. 146.

pale catechu, persulphate of iron (one part to three of starch), and eucalyptus are the most efficacious ; but the eucalyptus (one part of the gum to two of starch) is the preparation that I most rely on. The patient can often cleanse the naso-pharynx with a hand-wash or nasal douche, and may be taught to insufflate the powder himself.

In those fortunate cases in which great benefit has resulted from these measures, a complete cure may sometimes be effected by winding up the treatment with a course of Mont-Dore or Bourboule waters.

The diet should always be non-irritating, strong drinks and pungent food being carefully avoided. Lennox Browne [1] thinks that "it is advisable to restrict the amount of fluid food to a minimum." I have no experience of this method of treatment, and do not see how it could have much effect on a complaint of so chronic a type as the one under consideration. In all cases the use of tobacco should be given up, particularly the smoking through the nose, which is the practice of those who indulge in cigarettes.

Persons who show a predisposition to post-nasal catarrh should take special precautions against it. Travellers in dusty places—especially if the dust is of an alkaline character—should wear Gottstein's tampons (Fig. 73, p. 196) in the nose, and should also make use of respirators or keep the mouth constantly shut. Irksome as these measures may be, they are less troublesome than the annoying complaint against which they are meant to guard.

DRY CATARRH OF THE NASO-PHARYNX.

This disease closely resembles dry catarrh of the nose ; and to the article on that subject (p. 225 et seq.) the reader must be referred for a detailed description of the etiology and pathology of the disease. Like dry catarrh of the nose, it very frequently leads to ozæna. It is probably in most cases a sequel of moist catarrh, but sometimes it appears to be dry from the commencement. As in the case of moist catarrh of the naso-pharynx, it is most common in persons who have a somewhat roomy pharynx. On looking into the throat, the buccal pharynx may be simply dry and shiny, but on examining the naso-pharynx flakes of dry mucus of a dark-brown or black color are often seen. It is characteristic, however, of this form of catarrh for the objective symptoms to be very slight. When the complaint has reached the stage of ozæna a disagreeable smell is noticed in the breath, and every few days a round or oval mass, from two to three centimetres in length, and from one to two centimetres in width, is expelled. These lumps of inspissated secretion are generally of a dirty-white or green color, but they may be brown, or even black ; they are of somewhat dense consistence, moist externally, but dry and very compact toward the centre. Sometimes on section they show a sort of concentric arrangement, as if they were made of successive deposits. Their probable mode of detachment has already been explained in dealing with the nasal form of the complaint. Occasionally, by digital examination, one of these lumps can be felt in the naso-pharynx, occupying a corner of the vault on one side of the median raphe, or even extending right across it. The disease is frequently associated with a similar condition of the nose, but in some cases it is limited

[1] Op. cit., p. 164.

to the post-nasal region. On cleansing the mucous membrane it generally presents, after a short interval of time, a pale and atrophied appearance.

The remarks which have been made on the *diagnosis* and *pathology* of dry catarrh of the nose (see p. 230 et seq.) are applicable to the naso-pharyngeal region. Dry catarrh of the naso-pharynx is extremely obstinate, and the *prognosis*, as regards cure, is very unfavorable.

The *treatment* must be carried out in the way recommended for moist catarrh, but disinfectants are even more necessary. Dobell's solution, which has been already mentioned (p. 340), is one of the best sprays, but if continued for any length of time the proportion of carbolic acid should be reduced by one-half. The Nebula Alkalina of the Throat Hospital Pharmacopœia will also be found very serviceable.

ADENOID VEGETATIONS OF THE NASO-PHARYNX.

Latin Eq.—Tumores glandulosi pharyngis nasalis.
French Eq.—Tumeurs adénoïdes du pharynx nasal.
German Eq.—Adenoide Vegetationen des Nasenrachenraumes.
Italian Eq.—Tumori adenoidi della faringe nasale.

Definition.—Minute glandular vegetations growing from the vault and sides of the naso-pharynx, causing the voice to be dull and nasal in tone, the respiration to be buccal, frequently inducing deafness by setting up inflammation of the middle ear, and in the case of children often giving rise to the constitutional phenomena which follow prolonged nasal obstruction.

History.—In the year 1860 Czermak[1] observed two small tumors at the upper part of the naso-pharynx on the left side, close to the opening of the Eustachian tube, one portion of which somewhat resembled a "cock's comb." These were probably the first adenoid growths ever seen. Five years later Voltolini[2] reported the case of a man, aged forty-one, who had come under his care two years previously, on account of extreme deafness. Under various treatment the patient's hearing had greatly improved; but in the summer of 1865 Voltolini, on making a rhinoscopic examination, perceived "stalactite-like growths projecting into the free cavity of the naso-pharynx." These tumors having been destroyed in three sittings, by means of electric cautery, further improvement took place in the hearing. In the same year Löwenberg[3] published

[1] Der Kehlkopfspiegel und seine Verwerthung für Physiologie und Medizin, Leipzig, 1860. Soon after, Semeleder reported some cases of growths in the vault of the pharynx, but they seem to have been rather of the nature of fibrous polypi than adenoid vegetations (Die Rhinoscopie, etc., Leipzig, 1862, p. 46 et seq.).

[2] Allgem. Wien. med. Zeitung, No. 33, 1865. In the previous year Andrew Clark published a short article on Nasopalatine Gland Disease (Lond. Hosp. Reports, vol. i., p. 211), which I have no doubt was the same disease as that subsequently described by Meyer under the name of "Adenoid Vegetations." Clark remarked that this disorder can be "demonstrated only by rhinoscopic examination," but an otherwise accurate description of adenoid vegetations is marred by the statement that "fetid cheesy masses" are sometimes contained in the cavities of the glands. It is probable, therefore, that Clark's cases were complicated by the "exudative form of follicular pharyngitis." (See vol. i., p. 26 of this work.)

[3] Archiv für Ohrenheilkunde, 1865, Bd. ii., p. 116 et seq. These Archives are published in parts, vol. ii. covering the years 1865, 1866, and 1867, but Löwenberg's article appeared in 1865. As, however, the whole volume bears the date 1867, it has been erroneously supposed that Löwenberg's article was not issued till that year. In his recent work Löwenberg calls attention to these facts, which, on investigation, I have found admit of no dispute.

three cases in which he had found vegetations in the naso-pharyngeal region of patients suffering from deafness, which, he pointed out, were probably identical in their nature with the hypertrophied mucous glands characterizing granular pharyngitis. In 1868 Wilhelm Meyer,[1] of Copenhagen, for the first time gave a complete picture of glandular disease in the naso-pharyngeal region, under the name of "Adenoid Vegetations." While fully describing the symptoms and progress of the affection, he detailed the microscopic appearance of the growths, and pointed out a mode of surgical treatment which he had found highly effectual. Meyer had already at that time examined 2,000 children in the National Schools of Copenhagen, and had met with the affection in 1 per cent. of the cases examined. Indeed, he may be justly considered the discoverer of adenoid vegetations in the vault of the pharynx; for although not the first to observe these growths, he certainly first realized their importance, and fully described them. Subsequent workers have done little but confirm Meyer's observations. A short paper on adenoid tumors was presented to the International Medical Congress at Brussels, in 1875, by Guye,[2] of Amsterdam; and in the following year the subject was still further elucidated by Carl Michel,[3] of Cologne. A short note was published in 1879 by Victor Lange,[4] of Copenhagen, in which he suggested a modification of Meyer's method of operation; and in the same year an excellent account of the disease was given by Solis Cohen[5] in the second edition of his valuable work. Löwenberg,[6] moreover, returned to the subject in 1879, when he published a very complete monograph on the disease. Special mention may also be made of a paper by Tauber,[7] of Cincinnati, who found .6 per cent. of adenoid growths among his cases of nasal and pharyngeal disease. Adenoid vegetations were made the subject of public discussion at the International Medical Congress, held in London in 1881, when most of the above-mentioned writers gave the result of their increased experience; and Capart, of Brussels, who has been very successful in his treatment of these growths, exhibited several hundred specimens—or, to speak more correctly, several large bottles filled with vegetations. On the same occasion, Woakes[8] read a paper founded on the observation of one hundred cases, and, in opposition to the usual opinion that they are of adenoid structure, maintained that these growths are mainly papillomatous in texture.

Etiology.—The disease is more commonly observed in the young than in adults. The great abundance in the naso-pharynx of children of lymph-follicles, some of them solitary, and others united to form the tonsil of Luschka (vol. i., pp. 1, 2), explains the frequent occurrence of allied morbid growths in early life. That lymphoid tissue is also easily excited to active growth in young subjects is seen in the case of the tonsils and cervical glands, and it is highly probable that very slight catarrh of the naso-pharynx often leads to the excessive development of the tissue in question. It must not, however, be forgotten that vegetations which in children would cause marked symptoms, might produce but little inconvenience in the larger naso-pharynx of the adult, and hence that they may be easily overlooked in the latter case. Sex has no influence: out of 102 cases observed by Meyer,[9] 52 belonged to the male and 50 to the female sex; while Woakes[10] found the complaint almost equally prevalent in the two sexes. In 82 cases[11] seen by myself, 47 were females and 35 males. Between the ages of five and ten there were 51; between ten and fifteen,

[1] Hospitals Tidende, November 4 and 11, 1868; also Trans. Med. Chir. Soc., London, 1870, vol. liii., p. 191 et seq.

[2] International Med. Congress, Brussels, 1875.

[3] Krankheiten der Nasenhöhle und des Nasenrachenraumes, 1876, p. 77 et seq.

[4] Note sur les Tumeurs adénoïdes, Copenhague, Août, 1879.

[5] Diseases of the Throat and Nose, New York, 1879, second edition, p. 253 et seq.

[6] Tumeurs adénoïdes du Pharynx nasal, Paris, 1879.

[7] Cincinnati Lancet and Clinic, April 24, 1880.

[8] Trans. Intern. Med. Congress, London, 1881, vol. iii., p. 291 et seq. See also this author's work on Deafness, Giddiness, etc., London, 1880, p. 32.

[9] Loc. cit., p. 208.

[10] Loc. cit.

[11] These were all observed before the end of 1879. Since then I have, of course, seen a great many additional cases.

27; between fifteen and twenty, 2; and at the ages of twenty-four and twenty-seven, one. Dr. Felix Semon has furnished me with a table of 56 cases observed by himself, in 53 of which the patients were under twenty years of age. Dr. Semon, however, thought that in all the cases the disease commenced in the first decade of life. Golding Bird [1] has recently reported two cases in which the first symptoms of the complaint showed themselves after the age of forty. The number of observations hitherto collected, however, with reference to age and sex, is at present too limited to furnish any trustworthy conclusion; and it may be remarked that for statistics as to age to be of any value etiologically, it would be necessary to ascertain when the growths first commenced.

It is likely that the acute exanthems, and whooping-cough, which so frequently give rise to a catarrhal condition of the lining membrane of the throat, may have some influence in producing adenoid growths.[2] It has been suggested that those who inherit a scrofulous constitution are more liable to the development of the disease than others; but in connection with this point I may remark that my experience is quite in accordance with that of Meyer, for I have noticed that children suffering from adenoid vegetations seldom show any other marked sign of struma, such as enlarged cervical glands, ophthalmia tarsi, or otitis. In some of the cases published by Löwenberg [3] heredity appears to have had a marked influence, but here again the statistics are too limited, and, moreover, attention has been directed to the subject too recently for satisfactory observations to have been collected. In the next generation this point will be more easily determined. A cold moist climate has probably a considerable influence in the production of the disease, which is much more prevalent in the north than in the south of Europe.

Meyer [4] points out that in three out of four cases of cleft palate which came under his notice, these growths were present, and he attributes this to the direct irritation to which the mucous membrane is subjected from food and cold air. Oakley Coles,[5] who has had an exceptionally large experience in connection with cleft palate, has noticed the extremely frequent association of adenoid vegetations with this deformity. I do not know what the cause of the occurrence of these growths may be in these cases, but I may add that I have scarcely ever met with an example of cleft palate without finding a profusion of adenoid growths in the naso-pharyngeal region.

Symptoms.—In infants the first symptom to attract attention is, as a rule, "hard" breathing or snoring during sleep, sometimes even such attacks of dyspnœa as have been described under the head of Acute Coryza in Infants (p. 204). In older children it is the dull voice and deafness which generally claim our notice. It will mostly be found that symptoms of chronic catarrh of the nose and naso-pharynx exist; and on looking into the throat, a yellowish-green secretion may be seen trickling down the back wall of the pharynx. In the morning, the child's pillow is occasionally found stained with dark mucus, and sometimes with a little blood, which has dribbled from the mouth during sleep. In rare cases, indeed, the patient expels a small quantity of pure blood. The constantly open mouth and a certain stupid expression of countenance are, in the

[1] Guy's Hosp. Reports, 1881, third series, vol. xxv., pp. 441-443.
[2] See vol. i., p. 218 et seq. [3] Op. cit., p. 12. [4] Loc. cit., p. 209.
[5] Proc. Royal Med.-Chir. Soc. of London, November 23, 1869; Brit. Med. Journ., 1869, vol. ii., p. 619. See also Coles's work: Deformities of the Mouth, London, 1881, third edition, p. 51 et seq.

absence of enlargement of the tonsils, characteristic symptoms of post-nasal growths. David [1] has recently gone so far as to assert that these formations reveal themselves externally by a modification of the physiognomy, which consists essentially in a deformity of the upper jaw, with projection of the incisor teeth and narrowing of the palatine arch. He holds that the patient being only able to breathe through the mouth in such cases, the palate (still in course of development and comparatively soft) is subjected to constant pressure on its buccal surface, and thereby pushed unduly upward. This, however, is evidently an erroneous explanation of an irregular mode of development well known to dentists.[2] The deformity of the chest which has been described (vol. i., p. 48 et seq.) as occasionally associated with chronic enlargement of the tonsils, is not unfrequently present when post-nasal vegetations block up the naso-pharynx. Noisy respiration while the child is awake, and, as already observed, snoring during sleep, are also common symptoms of the affection. When the child is old enough to talk, it not only speaks "through its nose," as the term is popularly employed, but, in addition to this, the voice is muffled, or as Meyer terms it, "dead." In adults, this is sometimes the

FIG. 88.—Vegetations overshadowing Left Eustachian Aperture.

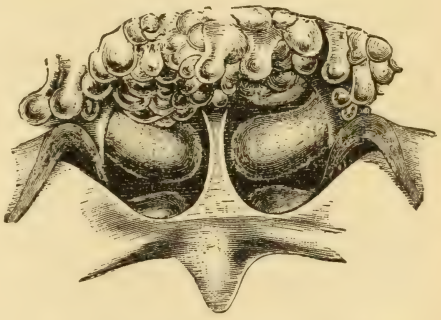

FIG. 89.—Adenoid Growths in the Vault of the Pharynx. (From a Young Woman.)

only symptom of the complaint, the other troubles having disappeared with the enlargement of the naso-pharynx. In cases of long standing, deafness often results from mechanical closure by the growths of the Eustachian orifice, a condition well exemplified by a case which I recently treated with Sir William Jenner and Dr. Gimson, of Witham (see Fig. 88). The hearing may also become impaired in consequence of the vegetations causing catarrh of the tube or even of the middle ear. (See Throat-deafness.)

On making a rhinoscopic examination, the growths can often be seen partly covering the posterior nares. They are generally of a pale color, but are sometimes pink, and even bright red; as a rule, they are rounded in form, and vary in size from a hemp-seed to a currant, but are occasionally much larger, and often occur in clusters. In some cases they hang down from the roof of the pharynx (Fig. 89) like stalactites, and, more rarely still, they are flat, like the granulations often seen on the posterior wall of the pharynx; sometimes a broad pad-like growth will stretch almost across the naso-pharynx. The vegetations are most abundant on the vault and upper part of the posterior wall of the naso-pharynx, but they are not un-

[1] Revue Mensuelle de Laryngologie, etc., 1883, No. 12, pp. 380, 381.
[2] See Oakley Coles: Op. cit., p. 86 et seq.

frequently grouped round the Eustachian orifices. Occasionally they cover the entire mucous membrane of the posterior nares, but the septum is seldom attacked. Owing to the difficulties which have been already described (see Rhinoscopy, p. 171 et seq.), it is not always possible, especially in young children, to make a rhinoscopic examination; but by passing the index finger behind the uvula the growths can generally be easily felt, when they are found to be smooth, soft, and yielding to the touch, and prone to bleed. When they are abundant, as was first pointed out by Meyer,[1] they give a sensation very much like a bunch of earthworms. Not unfrequently, however, separate vegetations can be felt.

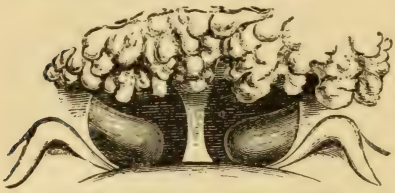

FIG. 90.—Adenoid Growths in a Child.

Diagnosis.—The morbid conditions with which adenoid growths may be confounded are: chronic catarrh, general hypertrophy of the mucous membrane about the posterior nares, polypus, and post-pharyngeal abscess. It is very unlikely that the merest tyro would confound fibrous or bony tumors or exostoses from the walls of the naso-pharynx with the complaint now under consideration. The condition of the mucous membrane of the nares can usually be ascertained by anterior rhinoscopy, and hence catarrh and thickening can generally be readily eliminated. In cases, however, where these conditions coexist with adenoid growths, the diagnosis can only be made by direct observation, or digital examination. Those who are inexperienced in rhinoscopy should look for the upper arches of the posterior nares, for if their sharp outline is obscured by any tissue hanging down over them, this is exceedingly likely to be of adenoid nature. This is the plan which Dr. Felix Semon informs me he is in the habit of recommending to his class, and it appears to me to be an exceedingly good one. Polypi are extremely rare before the age of sixteen, and retro-pharyngeal abscess, though often insidious, is accompanied with pain and difficulty in swallowing, and the symptoms come on much more rapidly than those caused by adenoid growths. The abscess, moreover, in most cases comes into view, or, at any rate, can be felt with the finger, and there is usually some tenderness on pressure. Fibrous tumors of the naso-pharynx rarely commence before the age of fifteen, and it is only in their very earliest period that they can be confounded with adenoid growths, for, as a rule, they grow rapidly, and soon cause so much displacement of the surrounding tissues that their nature cannot be mistaken. Osseous tumors are seldom, if ever, met with except in adults, and, when large enough to give rise to obstruction, generally cause pain and hemorrhage. Digital examination also at once enables the practitioner to recognize their nature.

Notwithstanding the number of diseases with which it is possible that adenoid vegetations might be confounded, yet, taking into consideration the age of the patient and the marked symptoms caused by the growths, there is practically very little likelihood of a mistake occurring.

Pathology.—Microscopic examination of these naso-pharyngeal growths shows that they consist of cylindrical and sometimes ciliated epithelium, with an abundance of the retiform adenoid tissue of His, containing in its meshes quantities of lymph-cells. True follicles are also met with and

[1] Loc. cit., p. 193.

occasionally a conglomerate gland, and the structures are generally highly vascular. The glandular element is, as a rule, more marked in growths taken from the vault of the pharynx, while in vegetations removed from the lateral walls, the stroma of His is found in greater abundance. I am

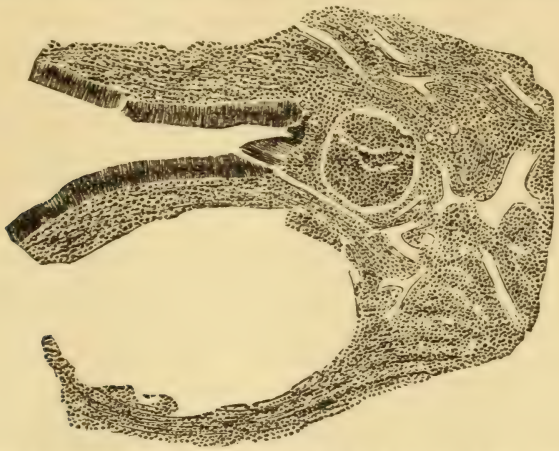

FIG. 91.—Section of Adenoid Growth (× 60). Showing a small portion of the cylindrical epithelium (whether ciliated or not cannot be determined) covering the surface, the vascular nature of the growths, the vast number of cells of which they are composed, and two follicles (similar to those seen in the tonsil), one of which is filled with cells, while the other is empty.

indebted to Mr. Butlin, of St. Bartholomew's Hospital, for admirable microscopical drawings (Figs. 91 and 92) of an adenoid growth which I removed by means of the "sliding forceps" from the extreme upper part of the vault side of the pharynx of a boy, aged ten, who suffered from deafness and a thick voice.

FIG. 92.—Portion of the same Growth as Fig. 91, but more highly magnified (×240). (The lymphatic or adenoid character of the tissue is very evident.)

Prognosis.—Considering that these growths can produce such grave evils as have been described, they ought not to be regarded too lightly; but, on the other hand, as frequently happens in the case of recently discovered diseases, there is at present, perhaps, a slight tendency to exaggerate their importance. Although the complaint may justly be looked

upon as serious when the vegetations are large enough to interfere with nasal respiration or to cause inflammation in the neighborhood of the Eustachian tube, it need not, as a rule, give rise to much anxiety. It is, indeed, highly probable that in many cases the growths spontaneously undergo atrophic changes in early adult life, while, as already pointed out, the larger size of the naso-pharynx makes their presence less injurious. Before adolescence has been reached, however, permanent deafness, defective articulation, and a lasting deformity of the thorax may have been produced.

Dr. Meyer informs me that in his experience the growths have a tendency to sprout up anew in greater luxuriance than before if the whole mass be not thoroughly cleared away, but I do not think that this observation accords with the experience of others who have given attention to the subject.

Treatment.—This consists in the removal or destruction of the growths. When they originate from the vault removal can best be effected with the cutting forceps of Löwenberg (see Nasal Instruments) or Solis Cohen.[1] Both these physicians appear to have suggested this mode of removal at about the same time. Cohen observes, "I have long used a gouge-cutting forceps, modelled on Mackenzie's similar instrument for cutting off laryngeal growths, with the shank curved to suit the anatomical disposition of the parts over which it must be passed."[2] The shape of Löwenberg's instrument with Woakes' modification of the cutting edges, appears to me rather more convenient than that of Cohen, the blades being shorter and forming a rather more obtuse angle with the shaft. In children who are likely to struggle much during the operation, or to resist its being repeated—that is to say, in those between eight and thirteen or fourteen years of age—I generally have chloroform administered. For younger children, however, and for adults I do not employ any anæsthetic. It is seldom that forceps can be used while the mirror is in position, and it will mostly be found sufficient first to make an accurate diagnosis and then immediately to introduce the forceps. Some operators guide the instrument with the index finger of the left hand; but this procedure is seldom necessary except when the patient is under an anæsthetic. For removal of growths from the lateral walls Löwenberg recommends a modification of Volkmann's sharp spoons, suitably curved for introduction into the posterior nares. In operating with this instrument the index finger of the other hand should be used for the purpose of firmly adjusting and securing the growth. For these vegetations, however, my sliding-forceps (Fig. 63, pp. 191, 192) will be found to answer well. Meyer lately recommended a somewhat similar instrument, but he still strongly advocates the use of his "ring-knife" (pp. 1 2, 193), and employs it almost exclusively. In this country, however, patients greatly dislike the passage of instruments of any size through the nose, and nearly all operators effect removal of the growths through the posterior nares.

Zaufal[3] has succeeded in removing vegetations from the naso-pharynx by passing through one of his funnels (Fig. 28, p. 168) a steel wire which, by an ingenious contrivance, is pushed out so as to form a loop and catch the growth. Capart[4] has adopted this method of expanding the loop and

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[1] Diseases of Throat and Nasal Passages, New York, 1879, second edition, p. 262. The author gives a woodcut of his instrument.

[2] Op. cit., p. 262.

[3] Prag. med. Wochenschr., 1878.

[4] Bull. Acad. Roy. de Méd. de Belg., 1879, 3e sér., xiii., 1151.

applied it to electric cautery. The latter physician also often uses a sort of ring-knife or sharp scraper, carried on a metallic finger-shield (see Nasal Instruments, Fig. 65, p. 193), while Guye,[1] of Amsterdam, uses his finger-nail for the same purpose.

In the course of operations on these growths there is often pretty free bleeding, and in some cases a hæmostatic is required. The nasal douche may be employed, cold water being passed through the nares, and powdered tannin or matico leaf may be insufflated behind the uvula. As a matter of fact, however, I have never met with hemorrhage profuse enough to require the use of any styptic.

If the electric cautery is used, Lincoln's instrument (Fig. 61, p. 191) would, no doubt, be found very convenient.

In order to re-establish respiration through the nose it is most important to teach patients to keep the mouth shut, and, during sleep, a chin-piece, with tapes to tie over the head, as recommended by Löwenberg,[2] may be worn, or a respirator, as suggested by Guye, of Amsterdam.[3] Löwenberg's plan appears to me most suitable for young children, and I have put it in practice once or twice with satisfactory results.

FIBROUS POLYPI OF THE NASO-PHARYNX.

Latin Eq.—Polypi fibrosi pharyngis nasalis. Polypi naso-pharyngei.
French Eq.—Polypes fibreux du pharynx nasal.
German Eq.—Nasenrachenpolypen.
Italian Eq.—Polipi fibrosi della faringe nasale.

Definition.—Tumors of fibrous structure, generally springing from the vault of the naso-pharynx, often extending into one of the nasal fossæ or even into the antrum, or reaching down in the pharynx to the epiglottis, and when of large size giving rise to great disfigurement of the face, to obstruction of the nose, and sometimes to considerable dyspnœa. These tumors, which are nearly always found in males between the ages of fifteen and twenty-five, are generally solitary, bleed very readily when touched and sometimes spontaneously, have a marked tendency to recur after removal, and show a disposition to arrest of development or even atrophy after the age of twenty-five.

History.—Although mention is frequently made by the older writers of polypi hanging from the back of the nasal passages into the pharynx, the literature of naso-pharyngeal fibromata may be said to begin with Manne's[4] account of his method of removing such growth, which was published in the early part of last century. Soon after the subject was briefly referred to by Garengeot,[5] and a few years later Manne[6] published a second tract containing some additional cases. Examples were recorded by Taranget[7] and Eustache,[8] and a somewhat elaborate memoir on naso-pharyngeal polypi, valuable even now for the number of carefully related cases which it contains,

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[1] Trans. Intern. Med. Congress, London, 1881, vol. iii., p. 290.
[2] Op. cit., p. 70. [3] Intern. Med. Congress, Brussels, 1875.
[4] Dissertation curieuse au sujet d'un Polype extraordinaire qui occupoit la Narine droite, qui bouchoit les deux fentes nasales, et qui descendoit par une grosse masse extirpée à un pastre du Dauphiné. Avignon, 1717.
[5] Traité des Opérations de Chirurgie, Paris, 1731, t. iii., p. 50 et seq.
[6] Observation au sujet d'un Polype extraordinaire. Avignon, 1747.
[7] Documents inédits de l'Académie R. de Chirurgie, republished by Verneuil; see Gaz. Hebd. de Méd. et de Chir., June 15, 1860, p. 388. [8] Ibid.

was presented to the Royal Academy of Surgery of Paris by Icart,[1] in 1731. In Levret's[2] work on polypi some valuable suggestions were made for the removal of fibrous growths of the naso-pharynx, chiefly by means of ligature, of which method this ingenious surgeon was the inventor. Morand[3] afterward succeeded in removing a polypus with his fingers alone, by what he called "ébranlement"—that is to say, by rocking the tumor on its base between one finger introduced as far as possible into the nostril, and one or two fingers of the other hand passed up behind the soft palate. A few years later Nannoni[4] removed a large naso-pharyngeal growth by Manne's method. Early in the present century Whately[5] devised an ingenious plan for guiding scissors or cutting-forceps to the base of such tumors. In 1816 Ansiaux[6] reported a case in which he used Manne's method, and failing to get the growth away with forceps, destroyed it by repeated cauterizations. In 1832 Syme,[7] in dealing with a naso-pharyngeal polypus, for the first time removed the upper jaw as a preliminary step toward extirpation of a tumor not connected with that bone itself. Mott,[8] of New York, was referred to by Syme as claiming to have excised the upper jaw for naso-pharyngeal polypus at about the same date, but I have not been able to find any record of his case. In 1834 Dieffenbach[9] published a number of cases in which he had removed fibromata with the bistoury, scissors, and forceps, generally dividing the soft palate as a first step. This, as already shown, had been frequently done before, but solely for the purpose of opening a freer way of access to the tumor, whereas Dieffenbach was, so far as I am aware, the first to point out how valuable this measure may be in itself for the relief of the urgent dyspnœa often caused by the presence of a large fibrous polypus in the naso-pharyngeal region. Blandin[10] put in practice with some success a method which is merely Morand's "ébranlement" carried out with forceps instead of the fingers. In 1840 Flaubert[11] removed the whole of the upper jaw for the eradication of a growth which had baffled several previous attempts to remove it by ordinary means. He was apparently under the impression that his was the first operation of the kind, and, in fact, ablation of the superior maxillary for disease unconnected with that bone is, even now, spoken of by French writers as "Flaubert's operation." It has been shown, however, that he was anticipated, both in the conception and the performance of this operation. Adelmann[12] reported a case of a very large naso-pharyngeal polypus which (besides other ravages) had perforated the hard palate. This opening, enlarged by division of the soft palate with the knife, was used as a way of access to the tumor. This possibly suggested to Nélaton[13] his plan of trephining the hard palate, which, though rarely if ever practised in this country, has apparently found great favor among French surgeons. Nélaton devoted much attention to naso-pharyngeal growths, their attachments, and the means of extirpating them. Although little is to be found on the subject in his own writings, his views have been fully set forth, and his cases and methods of treating them have been related by several of his pupils.[14] Chassaignac,[15] Langenbeck,[16] Huguier,[17] Demarquay,[18] and Ollier,[19] have invented different methods of "temporary resection" of the bony roof of the nose or of part of the upper jaw, while Roux[20] has suggested a method of "mobilizing" the whole of the upper jaw, enabling

[1] Documents inédits de l'Académie R. de Chirurgie, republished by Verneuil; see Gaz. Hebd de Méd. et de Chir., July 20, 1860, p. 465.

[2] Obs. sur la Cure radicale de plusieurs Polypes. Paris, 1771.

[3] Opuscules de Chirurgie, Paris, 1772, 2me partie, p. 196.

[4] Nessi: Istituz. di Chirurgia, Venezia, 1787, p. 228.

[5] Cases of two extraordinary Polypi removed from the Nose. London, 1805.

[6] Clinique Chirurgicale, t. viii., Liège, 1816, p. 137 et seq.

[7] Edin. Med. and Surg. Journ., vol. xxxvii., p. 322.

[8] Ibid. The statement rests on a private letter from Mott.

[9] Chirurgische Erfahrungen, Berlin, 1834, Dritte und Vierte Abtheilung, p. 236 et seq.

[10] Dict. de Méd. et de Chir. prat., art. Polypes, Paris, 1835, t. xiii.

[11] Arch. Gén. de Méd., 1840, 3me série, t. viii., p. 436 et seq.

[12] Untersuchungen über Krankhafte Zustände der Oberkieferhöhle. Dorpat und Leipzig, 1844.

[13] Botrel: D'une Opération nouvelle dirigée contre les Polypes naso-pharyngiens. Paris, 1849. Nélaton's first operation was done in 1848.

[14] Botrel, Desgranges, D'Ornellas, Vauthier, Robin-Massé.

[15] Traité des Opérations chirurg., t. ii., p. 448. [16] Deutsche Klinik, No. 48, 1859.

[17] Bull. de l'Académie de Méd., Paris, May 28, 1861.

[18] Gazette Hebdomadaire, August 29, 1862, p. 554.

[19] Bull. de la Soc. de Chir., 1866, p. 263 et seq.

[20] Gazette des Hôpitaux, July 30, 1861.

the surgeon to separate the two maxillaries, and thus obtain the widest possible view of the pharynx and base of the skull. This formidable procedure, however, has never been attempted on the living subject. The operations performed by Langenbeck and Von Bruns were described in 1872 by Paul Bruns,[1] who claimed for these surgeons the merit of devising the methods which are generally attributed to Huguier and Chassaignac. An elaborate article was published by Gosselin and Denonvilliers,[2] which has served as a very useful storehouse for subsequent writers on naso-pharyngeal growths. Maisonneuve[3] modified Manne's operation by making a "button-hole" in the soft palate instead of completely dividing it. On the other hand, Nélaton's procedure was altered by Richard,[4] who trephined the hard palate without dividing the velum. A very full account of naso-pharyngeal growths was given in 1864 by Robin-Massé,[5] who wrote as a professed follower of Nélaton. Several English and American surgeons have reported cases of naso-pharyngeal polypi, for the removal of which severe surgical measures were found necessary; among them may be mentioned Bryant,[6] Cheever,[7] Rouse,[8] Thomas,[9] Waterman,[10] Clark,[11] Cooper Forster,[12] Whitehead,[13] Sands,[14] Berkeley Hill,[15] MacCormac,[16] Ratton,[17] Ogilvie Will,[18] and Henry Morris.[19] A good description of the various operative methods of dealing with these growths was published by Sands,[20] in 1873, and in the following year Cheever,[21] in describing a new plan of temporary displacement of the upper jaw, compared the different "preliminary operations" together in a very judicial spirit. A short but complete essay on naso-pharyngeal tumors was published in 1878 by Bensch,[22] and Spillmann's[23] recent article on the same subject is full of information. The latest contribution to the literature of these growths is an instructive paper by R. P. Lincoln,[24] giving the results of different modes of treatment in fifty-eight cases.

Etiology.—The disease is decidedly rare. Paget[25] states that he has never had an opportunity of examining any of these growths in the fresh state, and indeed that he has seen very few of them in any condition. It would appear, however, from the numerous cases recorded by French surgeons, that the affection is less uncommon among their countrymen than it is with us. Fibrous tumors of the naso-pharynx generally originate between the ages of fifteen and twenty-five, but they occasionally commence in infancy, and more rarely after the period of adolescence is passed. Bensch[26] has collected 118 cases of tumor in the naso-pharynx, many of which, however, for various reasons, he excludes from consideration. Some were clearly of malignant nature, others cartilaginous or simply mucous in structure, while many of the cases were too incompletely reported to be made use of. Allowing for these omissions, there remain 66 cases, and in 58 of these the patients were males from eleven to twenty-

[1] Berlin klin. Wochenschrift, vol. ix., pp. 138 and 149.
[2] Compendium de Chirurgie pratique, vol. iii.
[3] Gazette Hebdomadaire, September 2 and 10, 1859, p. 612.
[4] Beuf: Des Polypes fibreux de la Base du Crâne, Thèse de Paris, 1857.
[5] Des Polypes naso-pharyngiens. Paris, 1864.
[6] Trans. Path. Soc, London, vol. xviii., p. 107.
[7] Boston Med. Surg. Journ., March 11, 1869.
[8] Lancet, February 27, 1869.
[9] Ibid., May 1, 1869.
[10] Boston Med. Surg. Journ., April 8, 1869.
[11] Ibid., October 19, 1871.
[12] Lancet, May 20, 1871.
[13] New York Med. Record, January 2, 1872.
[14] Brown-Séquard's Arch. of Med., June, 1873.
[15] Lancet, June 20, 1874.
[16] St. Thomas' Hosp. Rep., 1875, p. 65 et seq.
[17] Lancet, November 3, 1878.
[18] Ibid., December 6, 1879.
[19] Med. Times and Gaz., June 4, 1881; and Ibid., June 11, 1881.
[20] Loc. cit.
[21] Boston Med. Surg. Journ., 1874, vol. xc., p. 545 et seq.
[22] Beiträge zur Beurtheilung der chirurg. Behandlung der Nasenrachenpolypen. Breslau, 1878.
[23] Dict. Encyclop. des Sciences Méd., 1881, 2me série, t. xiii., art. Nez.
[24] Archives of Laryngology, 1883, vol. iv., No. 4, p. 258 et seq.
[25] Lectures on Surgical Pathology, London, 1870, third edition, p. 475.
[26] Op. cit., p. 106 et seq.

five years of age ; 7 of the remaining 8 occurred in boys under ten years of age, while in the eighth case the patient was a girl of fourteen.[1] Bensch's table contains examples of patients of *both* sexes[2] over twenty-five years of age, but even when the tumors were fibrous in structure, these cases had not, according to Bensch, presented the *clinical* features which are considered to be truly characteristic of naso-pharyngeal fibromata. Lincoln's statistics comprise 59 examples of naso-pharyngeal tumor, reported in the period from 1867 to 1873, and of these probably not less than 38 were genuine fibromata, in all of which the patients were males under the age of twenty-five. Nélaton,[3] indeed, went so far as to say that he did not know of a single authentic example of true naso-pharyngeal fibroma becoming developed in a female of any age, or in a male over thirty-five. While granting that the law thus laid down is too absolute, the fact remains that instances of the disease occurring in women must be looked upon as altogether exceptional.

There is no evidence that the affection is hereditary, though one congenital case has been recorded.[4]

The causes which lead to the development of naso-pharyngeal fibromata are unknown, but the disease is probably due to an irregular evolution, during the growing period, of a tissue which under normal conditions is exceptionally abundant on the under surface of the base of the skull. The age (fifteen to twenty-five) at which these growths are most prone to originate is precisely the time at which many of the fibrous tissues of the body are in the most important stage of their development. It is then that the articular ligaments are acquiring their full firmness, and it seems not unlikely that it is to an exaggerated plastic activity during this phase of development that these terrible growths owe their origin.

Symptoms.—In the early stages of the complaint the patient becomes aware of some obstruction of one or other nostril, and suffers from a disagreeable feeling at the back of the nose. As the disease develops, both nasal passages generally become completely obstructed, and if the growth hangs low in the pharynx there is often considerable dyspnœa. There is usually deafness of one ear, and sometimes both sides are affected. The articulation is frequently indistinct, and even unintelligible, from pressure on the soft palate, while dysphagia is occasionally a troublesome complication. A curious symptom which has been observed in many of these cases is drowsiness, the patient sometimes falling asleep even when standing upright. Whately[5] gives remarkable illustrations of this symptom in the case of his patients, one of whom would fall asleep in his shop in the act of serving a customer, or even when on horseback in the street ; while another, who was a barber's apprentice, went to sleep when curling a customer's hair, and dropped the hot iron on his head. A great sense of fatigue accompanies this drowsiness. There is generally an abundant purulent secretion, which is sometimes of a fetid character. Epistaxis is of almost constant occurrence, and is often very severe. Thus Whately[6]

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[1] This case is reported as that of a woman aged twenty-five, but she had suffered from the complaint eleven years.

[2] Among these is one of Verneuil's (Bull. de la Soc. de Chir., 1873, t. ii., 3me série, p. 347), in which the patient was a woman aged sixty-two.

[3] Rapport sur les Progrès de la Chirurgie, by MM. Denonvilliers, Nélaton, Velpeau, etc., Paris, 1867, p. 325.

[4] Voisin : cited by Verneuil, Gaz. Hebd., 1860. From Documents inédits tirés des Archives de l'ancienne Académie de Chirurgie.

[5] Op. cit., pp. 3 and 20.

[6] Op. cit., p. 2.

mentions that in one of his cases the patient bled at the nose on three different occasions at intervals of a year, the hemorrhage each time lasting six days, and the amount of blood lost being between four and five pints. The bleeding is in many instances so frequent and profuse that the patient is reduced to a dangerously anæmic condition.

By means of posterior rhinoscopy the growth can be seen at an early period of the disease, and it can also be felt with the finger. It is generally smooth, hard and unyielding, red or purple in color, and often ulcerated and covered with sanious secretion. The tumor is usually pedunculated, the stalk, however, in most cases being broad. There has been much controversy as to the exact seat of implantation of these fibromata. The usual opinion is that they may spring from the vomer, the inner surface of the pterygoid processes, the front of the upper surface of the upper cervical vertebræ, or, in fact, any part of the roof or lateral walls of the naso-pharyngeal cavity. Nelaton,[1] however, whose teaching has been widely accepted in France, holds that the primary point of origin is in all cases the periosteum covering a limited area on the under surface of the base of the skull corresponding to the basilar process of the occipital and the body of the sphenoid bone. He maintains that where the tumor appears to be attached to other parts, either in the naso-pharynx or the nose, these are merely points where secondary adhesions have been contracted in the course of expansion of the growth. It may, at least, be admitted that this view is correct in the great majority of cases. In order to ascertain its exact origin, it is often useful to introduce a probe through the nostril while the finger is in the mouth, for by this means the polypus can be moved and its relations more easily made out. As the mass enlarges, it becomes visible in the pharynx, while in other cases where it hangs down into the throat, additional room can be obtained by drawing the velum forward (see p. 171 et seq.).

The subsequent symptoms depend on the direction which the tumor may take in its development. If it extends toward the throat it presses the soft palate forward and interferes with deglutition. At the same time it generally causes inflammation, which may spread along the Eustachian tube, set up catarrh of the middle ear, and thus give rise to considerable deafness. If the tumor grows into the nose it may separate the nasal bones from each other, flatten out the bridge, at the same time pushing the eyes farther apart and making them bulge almost out of the orbits, thus producing the hideous deformity known as "frog-face." It may also press on the lachrymal canal and cause epiphora. Should the mass extend outward it may displace the eyeball, causing exophthalmia, and even setting up destructive inflammation of the eye, or it may reach into the antrum, giving rise to a large swelling in the cheek. A similar effect is produced when the growth projects through the pterygo-maxillary fissure and extends to the cheek beneath the zygoma. The most dangerous extension is upward through the base of the skull, the cranial cavity being opened, and the substance of the brain pressed on or destroyed by the invading mass. It is remarkable, however, that the cranium may be perforated or eroded over a considerable area by the tumor without any cerebral disturbance being produced.[2]

Diagnosis.—In the early stages the disease can generally be recognized

[1] Robin-Massé, op. cit., p. 12.

[2] See several cases in a thesis by Petit, De quelques Considérations sur les Polypes naso-pharyngiens et leur Propagation au Cerveau, Paris, 1881, pp. 25, 26, 32, and 37.

with the rhinoscope and by digital examination, and when well advanced it can scarcely be mistaken for any other affection. It is often impossible to distinguish between fibrous tumors and sarcomata except by microscopic examination, but the age and sex of the patient greatly assist in arriving at a correct opinion. Cartilaginous tumors are so rare in the naso-pharynx, that they may be excluded from consideration, and bony growths have never been observed in that region. Occasionally curious and almost unavoidable mistakes have been made. An instance of this is the well-known case in which Vacca Berlinghieri [1] endeavored to remove what appeared to be a polypus, but proved to be a neuroma of the size of a peach on the second division of the fifth nerve. The case already mentioned (p. 253), in which a hernia of the brain simulated a polypus, may be again referred to. Sometimes the ophthalmoscope may reveal evidence of pressure on the optic nerve, but in a case reported by Ollier [2] cerebral symptoms occurred without any atrophy of the disc having been observed.

Pathology.—Fibrous tumors of the naso-pharynx present the ordinary characters of fibromata. They are exceedingly dense, and only differ from similar growths in other situations in being, as a rule, destitute of elastic fibres. The vessels in the substance of the tumor are usually small, while those of the investing membrane are often of large size. According to Gross,[3] all these vessels have very brittle walls, and it is to this peculiarity that he attributes their proneness to bleed, a tendency which is further favored by the fact that the vessels are imbedded in a dense fibrous network which does not allow of their retraction when cut. Muron,[4] who made a careful examination of a growth removed by Verneuil from a boy between fifteen and sixteen years of age, states that in that case the vessels, which were exceedingly numerous, had for the most part a more or less embryonic structure. The walls of the smallest consisted merely of a single row of slightly fusiform cells, others had two such rows, while some had three or four. The vessels presenting a fully organized structure with the ordinary three coats were extremely few in number. Occasionally a considerable portion of the tumor may be of true erectile structure,[5] and in such cases hemorrhage is, of course, partially likely to occur. Virchow [6] suggests that this is in some cases due to an extension of the cavernous structure normally covering the turbinated bones.

Prognosis.—This is unfavorable, unless the disease be recognized and treated at a very early stage. The only satisfactory feature in these growths is that they do not tend to increase, but rather show a disposition to become absorbed, after the age of twenty-five. If, therefore, by repeated removal, the spread of the disease can be kept within bounds, its spontaneous arrest may fairly be looked for when the period of adolescence is past. An example of the disappearance of a fibroma without any treatment whatever has been related by Lafont.[7] The patient was a man aged twenty-four, who had suffered from the characteristic symptoms for three or four years, and who when seen had a large naso-pharyngeal growth with prolongations into the nose and cheek. As the symptoms were not urgent, surgical measures were postponed, and a few months later the patient

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[1] Arch. Gén., t. xxiii., p 431. [2] Bull. de la Soc. de Chirurgie, 1866, p. 264.
[3] System of Surgery, Philadelphia, 1872, fifth edition, p. 371.
[4] Bull. de la Soc. de Biologie, July 3, 1869, p. 223.
[5] E. Neumann: Virchow's Archiv, Bd. xxi., p. 280.
[6] Die Krankhaften Geschwülste, Bd. iii., p. 463.
[7] Gaz. Hebdom., January 15, 1875, p. 37.

returned with hardly a trace of the tumor remaining. Fibrous tumors of the naso-pharynx have also sometimes sloughed away. In an instance related by Birkett [1] this took place after repeated hemorrhages, for which deligation of the left common carotid had been necessary. Another example [2] of sloughing of a naso-pharyngeal growth, which had recurred after evulsion with forceps, was seen in a woman in St. George's Hospital. In this case it is stated that the tumor disappeared "so entirely . . . that no trace could be discovered of any part remaining."

Treatment.—The method of dealing with these growths is likely to undergo a fundamental change. Until a comparatively recent period they had, as a rule, attained considerable dimensions before their true nature, or in some cases, their very existence, was discovered. Now, however, that the nose and naso-pharyngeal region can be throughly examined by direct inspection, fibromata are sure to be observed at a stage when they are amenable to treatment of a tolerably mild nature. It is not improbable, therefore, that the severe "preliminary operations" presently to be described, may, after a time, become almost obsolete, and that electric cautery applied *per vias naturales* will, in great measure, supersede all other methods. Should the growth, however, have reached a large size before the patient comes under observation, the first question which the surgeon will have to decide is whether an attempt at radical cure should be made, or whether merely palliative measures should be adopted. The natural tendency of the disease to come to a standstill after the twenty-fifth year affords a strong argument in favor of doing nothing in the way of active treatment beyond what is absolutely required for the relief of urgent symptoms. An excellent illustration of this has been furnished by Gosselin.[3] The disease had first attracted the patient's attention by the usual symptoms, when he was between sixteen and seventeen years of age, but it was not till three years later that he sought medical advice. Almost every method was employed for the radical extirpation of the growth, but recurrence was very rapid after each operation, and Gosselin was finally obliged to allow the patient to leave the hospital for the ostensible purpose of recruiting his health before submitting to further measures. But at this time his face was hideously deformed, there was distinct evidence of commencing pressure on the brain, and his vital strength was at the lowest ebb. Gosselin owns that he looked upon the lad as inevitably doomed to death at no very remote date. He saw his patient once more, however, when he had reached the age of five-and-twenty, and was astonished to find that, although no treatment whatever had been attempted in the meantime, all trace of the growth had disappeared. Gosselin is, therefore, strongly of opinion that while urgent symptoms, such as difficulty of breathing or swallowing, or great loss of blood from the nose, should, if possible, be palliated by the removal of part of the growth, the bulk of it should be left alone. If, when adolescence is complete, the mass is still unabsorbed, thorough eradication may be attempted with a fairly well-founded hope that there will be no return of the disease.

Electric cautery is, as already remarked, the plan of treatment which will probably prevail in the future. It is safe and easy of application, and Lincoln's [4] recently published results conclusively show that it is thoroughly

[1] Brit. Med. Journ., February 13, 1858, p. 119.

[2] Ibid., January 23, 1858, p. 61.

[3] Clinique Chirurgicale de l'Hôpital de la Charité, Paris, 1873, t. i., Leçon 8me, p. 92.

[4] Archives of Laryngology, 1883, vol. iv., No. 4, p. 258 et seq.

effectual, when the growth is of moderate size. He has used it in three cases, in none of which has there been any sign of recurrence since the time of operation. Two of the patients have remained free from the disease for more than eight years, and the third has continued well during nearly eleven months. It is to be noted that the ages of those patients were respectively fifteen, seventeen, and twenty-one, so that all were within the period when the growth of fibromata is, as a rule, most active. Lincoln[1] quotes cases treated by electric cautery by Gulcke and Roth; in the former there had been no recurrence during four and a half years, while in the latter the patient had remained free from disease for two and a half years.

The best method of using electric cautery in these cases is, if possible, to remove the growth within the galvanic écraseur passed through the nose or mouth. The stump should afterward be thoroughly destroyed by electric cautery applied at such intervals of time as may seem desirable; once a week will be sufficient in most cases. The simplest and most convenient instrument for this purpose is Lincoln's post-nasal electrode (Fig. 61, p. 191).

Among other modes of treatment may be mentioned *electrolysis, ligation, removal with the écraseur, evulsion, excision, crushing, gouging, actual cautery,* and the application of *escharotics.*

Electrolysis can be carried out by means of any battery generating a continuous current of moderate strength. The operator should introduce one or more curved needles connected with the negative pole into the tumor behind the uvula, while the current from the positive pole is conducted to the growths by means of a needle passed through the nose, or a sponge-electrode placed in contact with the sternum. A convenient needle for the purpose of applying electrolysis to post-nasal tumors has been invented by Cohen.[2] The operation should be continued for ten or fifteen minutes at a time, and it may be made every day, or on alternate days. Very successful examples of this mode of treatment have been recorded by Nélaton,[3] Paul Bruns,[4] Ciniselli,[5] Fischer,[6] and Lincoln.[7] In Nélaton's case a bulky growth, which bled very easily, and which had resisted the cautery and escharotics, was dispersed by electrolysis in six sittings. In that of Bruns, a large tumor, which had baffled previous efforts to remove it with the snare, was destroyed by electrolysis. In this instance, however, the treatment had to be continued for eleven months; and one hundred and thirty sittings, each lasting about a quarter of an hour, were required. In Lincoln's case electrolysis was used as a palliative measure, the patient's weakness making a radical operation unadvisable. There were twenty-two sittings, the treatment being continued for about a year. At the end of that time the tumor had "shrunk very much in all dimensions, and the patient's health was so much improved that the remaining portion of the growth could be removed with the écraseur." In Gosselin's[8] case, already referred to, electrolysis was one of the methods resorted to, and it was tried under fair conditions. It was found, however, that although some diminution in the bulk of the tumor was effected at each sitting, this was so slight as to be regained by the natural process of growth by the next

[1] Archives of Laryngology, 1883, vol. iv., No. 4, pp. 274, 275.
[2] Diseases of Throat and Nasal Passages, New York, 1879, second edition, p. 270.
[3] Robin-Massé: Des Polypes naso-pharyngiens, Paris, 1864, p. 78.
[4] Berlin klin. Wochenschr., July, 1872, No. 27, p. 321; No. 28, p. 336.
[5] Gazette Médicale, 1866, p. 223. [6] Wien. med. Wochenschr., 1865, No. 61.
[7] Naso-pharyngeal Polypi, St. Louis, 1879, p. 6 et seq. Reprinted from the St. Louis Medical and Surgical Journal. [8] Loc. cit.

time electro-puncture was applied, so that no real progress was made. It may be added, that in this case the operation was so painful as to be extremely dreaded by the patient, who, nevertheless, had borne, without much complaint, repeated examinations and many attempts to remove his growth by cutting, ligature, and caustics.

Ligation.—Ligatures have been employed for the removal of these growths from an early period in the history of surgery. When the tumor has been thoroughly exposed by a "preliminary operation," a ligature can usually be applied with ease, but when strangulation has to be done *per vias naturales* there is often the greatest difficulty in placing the ligature round the stalk of the growth. To accomplish this an immense variety of instruments have been invented; indeed, almost every surgeon who has had occasion to apply this method has devised some fresh arrangement. Perhaps the simplest plan is that recommended by Dubois.[1] This consists in passing a double ligature through a piece of elastic catheter fifteen to thirty centimetres in length, to which a piece of colored thread is attached. As the ends of the ligature are gradually drawn out through the nostrils by means of Bellocq's sound, the surgeon, with his fingers in the patient's mouth, carries the open loop over the pedicle of the growth. When the loop is in position, the piece of catheter is removed by means of the colored thread. An obvious objection to this method is that it is useless in the numerous cases where it is impossible to reach the pedicle with the finger. In carrying out ligation, there is some danger, if the tumor be large, that when it separates it may fall down into the throat during sleep, and cause death by suffocation. In such cases, therefore, a thread should be passed through the body of the tumor, and brought out by the mouth, the two ends being tied round one of the ears. During sleep the patient must be watched in order that the polypus may at once be withdrawn should it become detached.

The great advantage of the ligature is that the danger from hemorrhage during the operation is reduced to a minimum. The disadvantage is that it is often extremely difficult to apply the ligature, except after a "preliminary operation," and that when the mass has come away a stump is left behind from which the growth may sprout anew.

Removal with the Écraseur.—For this purpose a strong, slightly curved instrument must be used, and a loop of suitable size having been made, it should be directed upward behind the uvula, and made to encircle the growth as close to its root as possible. In some cases it will be found easier to pass the wire round the tumor by pushing it, bent double, through the nose. In either case, when the wire is round the growth, its ends should be threaded through the eyes of the écraseur, and the loop gradually tightened.

Evulsion.—As in the case of mucous polypi, evulsion with forceps has its advantages. Instead, however, of the little delicate instruments which are used in dealing with soft growths, very powerful forceps are required for fibrous tumors. They must be curved at an obtuse angle, and the blades should be rough, or even toothed, to enable the operator to get a firm grasp of the tumor.

It is desirable to seize the growth as near its base as possible, and twist the pedicle as much as the space will permit. Such is the resisting character of these growths, however, that even when very strong forceps are employed, their blades are often wrenched so as to become useless. Oc-

[1] Gazette des Hôpitaux, February, 1863.

casionally the tumor may be seized with the fingers and torn off, but this can seldom be done until the origin of the polypus has been well exposed by a "preliminary operation."

In any case it is most important to follow any offshoots of the growth which may project into the nose, sphenoidal fissure, or antrum, and to root them out thoroughly. The great advantage of evulsion is that when the tumor is not very large it can be removed in this way without any "preliminary operation," and that it can often be torn away by the roots. The objection to it is that it altogether resists any reasonable degree of force,[1] and serious accidents may result from injudicious violence. Though Icart[2] has related an instance in which he brought away a fragment of the ethmoid bone as large as a shilling, without any bad consequences ensuing, it must not be forgotten that two of Ollier's[3] patients died from cerebral complications after evulsion. In one of these, however, the growth was found, on post-mortem examination, to have invaded the middle cerebral lobe. Cooper Forster[4] also lost a patient twelve days after evulsion, and the necropsy showed fracture of the cribriform plate of the ethmoid with general arachnitis and localized sloughing of the cerebral substance. A great part of the tumor having been left behind, it appears probable that these lesions were due to the operation.

Excision with a curved blunt-pointed bistoury was frequently performed by Dieffenbach, who, though he sliced these growths in the freest manner, did not meet with any dangerous hemorrhage; this experience, however, is of a very exceptional character, for Deguise,[5] Verneuil,[6] and Duménil[7] have reported cases in which death occurred from the furious bleeding which took place when the tumor was divided. Whately succeeded in curing a very severe case by excision, or rather amputation, with a curved knife. His mode of operation was ingenious, and at the same time simple. A string was first passed through the nose round the growth, and into the pharynx, from which it was drawn out of the mouth. The end of the string was then threaded through a small eye near the point of the knife, and the nasal extremity of the string being pulled tight by an assistant, while the other was held in the surgeon's left hand, the knife with its point carefully guarded was run along the string to the upper part of the pharynx, where the edge was guided to the base of the tumor, which was cut through. Although the diameter of the growth at the point of section was 2 by $1\frac{3}{4}$ inches, there was no serious bleeding.[8] In spite, however, of this experience of Dieffenbach and Whately, the danger of hemorrhage renders their plan of treatment unworthy of imitation.

Crushing.—This method has never been extensively practised. It was tried by Velpeau[9] with very powerful forceps armed with strong teeth. Different portions of the growth were successively seized, and violently compressed, and in this way a considerable portion of the tumor was destroyed. The crushed portions, together with some of the immediately adjacent parts of the polypus, subsequently sloughed away. Although

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[1] This has been especially observed by M. Ollier, the well-known surgeon of Lyons, who, considering their great rarity, has had an unusually large experience of these tumors.

[2] Loc. cit.

[3] Spillmann: Dict. Encyclop. des Sciences Médicales, 2e série, t. xiii., p. 100.

[4] Lancet, May 20, 1871.

[5] Bull. de la Soc. de Chir., March 13, 1861.

[6] Ibid., 1870.

[7] Ibid., June 18, 1873.

[8] Cases of Two Extraordinary Polypi, etc., London, 1805, p. 14.

[9] Bulletin de Thérapeutique, 1847.

cases have been reported by Dolbeau [1] and Jarjavay [2] in which this treatment was successful, it is so apt to give rise to septic infection that it has fallen into disuse.

Gouging.—This mode of treatment was once much in vogue. But though a favorite practice in the sixteenth and seventeenth centuries for the destruction of every kind of tumor, it does not appear to have been employed for the removal of naso-pharyngeal polypi till it was advocated by Borelli.[3] The method has since been followed by Guérin,[4] Bonnes,[5] and Herrgott,[6] but it requires the performance of a "preliminary operation," except in cases where the growth is attached to the base of the skull. Under these circumstances the plan is most conveniently carried out by passing an extremely fine chisel through the nose, and pushing it along the vault of the pharynx.

Although gouging is of very limited application for the active removal of growths, it has been extensively employed for destroying the stump when the bulk of the tumor has been taken away by some other plan. Baudrimont,[7] however, says that out of eight cases operated on by Dieffenbach recurrence took place in seven, in every one of which gouging had been carried out; while in the eighth case, in which cauterization was used instead of gouging, there was no recurrence of the disease. Ollier, on the other hand, affirms that he has no confidence in any method of treating naso-pharyngeal growths except by evulsion followed by vigorous gouging, and he is never satisfied that the latter procedure has been thoroughly carried out, unless he can feel that the bony tissue of the basilar process of the occipital bone has been scraped quite bare. While admitting that the periosteum which furnishes the elements for the reproduction of the tumor must be destroyed as completely as possible, a word of warning seems to be called for here against a too energetic use of the gouge. A case has come to the author's knowledge in which a distinguished surgeon, now deceased, actually drove the chisel into the patient's brain while scraping the vault of the pharynx.

Thermic Cautery.—The red-hot iron used by the older surgeons has been abandoned in favor of improved methods of applying the actual cautery.

Paquelin's thermo-cautery is available in some cases, and Nélaton successfully employed a single gas flame for the cauterization of the stump of a tumor which had been removed. For this purpose he used a small india-rubber ball full of gas, connected with an elastic tube, to which suitable nozzles of varying degrees of fineness could be adapted. The nozzle was provided with a stopcock, so that the flame could be exactly regulated in its application. By this means it was found possible to cauterize the parts very quickly and thoroughly, while radiation was so slight that the finger could be held at a distance of a centimetre and a half from the flame without any heat being perceived.

Escharotics.—Various agents of this kind have been employed in different ways. Nélaton treated some cases by the application of nitric acid passed through a suitably curved glass tube. In spite, however, of every

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[1] Spillmann: Loc. cit, p. 101. [2] Ibid. [3] Gaz. des Hôpitaux, 1860, p. 179.
[4] Bull. de la Soc. de Chir., June 24, 1866.
[5] Ibid., July 14, 1869.
[6] Quoted by Postel: Des Polypes naso-pharyngiens, Thèse de Paris, 1867.
[7] De la Méthode nasale dans le Traitement des Polypes naso-pharyngiens, Thèse de Paris, 1869.
[8] Traité expér. et clin. de la Régénération des Os, Paris, 1867, p. 485.

precaution, the vapor of this acid is apt to escape and give rise to violent dyspnœa. Moreover, to produce any real effect, the remedy must be applied daily for months. In France chloride of zinc paste (pâte de Canquoin) has been recommended by several surgeons, and a special apparatus has been devised by Desgranges[1] for maintaining the caustic in contact, as long as may be necessary, with the part to be destroyed. This consists of a thin metal plate, on the upper surface of which is placed the caustic agent, while the apparatus is kept in position by metallic bands which go round the head. Although I have never had an opportunity of trying them in a case of naso-pharyngeal fibroma, I think the caustic darts[2] which I am in the habit of occasionally using in cases of fibrous bronchocele might also here prove of service.

French surgeons distinguish two methods of employing cauterization, viz., the *rapid process* and the *slow process*. The former consists in freely cauterizing the stump of a polypus immediately after the bulk of it has been removed. The *slow* cure consists in keeping the base of the growth accessible for some weeks after a "preliminary operation" has been done, and applying the caustic every second or third day. The slow cure can be most conveniently carried out through the wound left after Nélaton's "palatine operation." This procedure, however, is objectionable, as almost necessarily leaving a permanent fissure of the palate; while, in the case of operations on the face, the prolonged maintenance of an open wound is likely to lead to hideous deformity.

Preliminary Operations for gaining Access to Naso-pharyngeal Tumors.— Although attempts have been made to dilate the orifice of the nostril by means of serpentary root, gentian, sponge, and more recently by laminaria, these methods are practically of little value, and, owing to the frequently inaccessible situation not less than to the large size and numerous offshoots of the growths, it often becomes necessary to expose the tumor by a preliminary surgical operation. This necessity was perceived at a very early period, and, on referring to the short historical retrospect prefixed to the article on Nasal Polypi (p. 245 et seq.), it will be seen that Hippocrates recommended that the nasal cavity should be laid freely open in cases where the application of the actual cautery was judged necessary. An operation of this kind seems to have been frequently done in the sixteenth and seventeenth centuries, but it had fallen into disuse until revived by Dieffenbach.[3] It has since been often performed with various modifications according to the exigencies of particular cases. The older surgeons carried the incision down to the centre of the nose, but, with the view of concealing the scar as far as possible, Garengeot[4] suggested that the cut should be made along the genio-nasal furrow.

At a later period more severe procedures came into use, the naso-pharynx being laid open by resection of the upper jaw, or the growth being reached by division of the hard palate. Hence the following preliminary operations for the removal of naso-pharyngeal tumors have come to be recognized, viz., 1, *nasal;* 2, *maxillary;* and 3, *palatine.*

These procedures are in themselves attended with considerable risk. Sédillot[5] and Demarquay[6] each lost a patient from hemorrhage in the

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[1] Gazette Hebdom., June 30, 1854, p. 633 et seq.

[2] These consist of one part of chloride of zinc to one or two parts of wheat flour.

[3] Op. cit.

[4] Traité des Op rations de Chirurgie, Paris, 1731, 2e éd., t. iii., p. 53.

[5] Spillmann: Op. cit., p. 145.

[6] Ibid., p. 146.

course of the "preliminary operation," and in twenty-one cases collected by Lincoln,[1] in which a "preliminary operation" was done, death took place on the table in three,[2] while in a fourth[3] the patient succumbed within a few hours. In a fifth[4] instance hemorrhage very nearly proved fatal during the operation. If Lincoln's statistics are accepted in the gross they show still less favorable results, for in thirty-nine cases in which "preliminary operations" were performed death quickly ensued in eight. In some of these, however, the disease was decidedly malignant, and they have, therefore, been excluded from consideration. Even as regards the twenty-one cases of undoubted fibroma, it must not be forgotten that a "preliminary operation" was presumably judged necessary because the tumor was very large, and the mortality may, therefore, have been in great measure due to the unavoidable violence which must sometimes be used in separating the mass from its attachments. The feeble and anæmic condition of the patients in such circumstances has also to be taken into account. It is hardly fair, therefore, to compare the statistics of cases in which "preliminary operations" have been performed with those in which a cure has been effected by means of electric cautery or any other simple method of treatment.

The various "preliminary" procedures must now be described in detail.

Nasal Operations.—Dupuytren[5] suggested opening the nasal fossa by an incision carried round the base of the nose, detaching the cartilages from the bone, thus enabling the operator to tilt up the tip of the organ, and explore the anterior orifice of the nares. Syme enlarged the aperture of the nostrils by dividing the upper lip in a vertical direction from a point midway between the septum and the ala of the affected side. The two flaps were then dissected well back on each side. A procedure, however, which, besides exposing the nasal cavity more freely, has the advantage of not causing an unsightly cicatrix, has been proposed by Rouge.[6] The following is his own description of this operation: "The patient is anæsthetized, and placed with his head bent toward the right side to allow the blood to escape, while the operator stands at the right side of the bed. Seizing the upper lip, near the commissure, with the thumb and index finger of the left hand, I lift it up a little, while an assistant does the same on the other side. The lip being so held and stretched out, I incise the mucous membrane in the gingivo-labial groove from the first molar tooth on the left side to the corresponding point on the right, the centre of this incision being at the frenum of the lip, which is divided at the root. I rapidly cut through the tissues in their whole thickness, and reach the anterior nasal spine, over the prominence of which the knife should be carried, detaching the cartilaginous part of the septum at its base. This

[1] Loc. cit., pp. 264–281. Lincoln's tables include altogether fifty-eight cases of naso-pharyngeal tumor. Of these seven were unquestionably malignant, three were fibro-mucous, while in ten the nature of the growth is either not stated, or from internal evidence (age or sex of the patient, cause of the disease, etc.) may be judged to have been not truly fibromatous. I have, therefore, reckoned only thirty-eight of Lincoln's cases as examples of the disease treated of in this article, and even a few of these must be looked on with some suspicion.

[2] Verneuil: Gaz. des Hôpitaux, August 9, 1870; Berkeley Hill: Lancet, June 20, 1874; H. Morris: Med. Times and Gaz., June 4, 1881.

[3] Ratton: Lancet, November 3, 1878.

[4] Sands: Brown-Séquard s Archives of Scien. and Pract. Med., June, 1873.

[5] Journal de la Clinique, 1830, t. ii.

[6] Nouvelle Méthode Chirurgicale pour le Traitement de l'Ozène. Lausanne, 1873.

often suffices, for by raising the nose there is room to introduce the finger into the nasal fossa, and a good view can be obtained of its cavity when the blood has been sponged out. If, however, this does not suffice, the alar cartilages should be separated from their attachment to the upper jaw with scissors, and the nose being thus completely detached, should be thrown upward upon the forehead, when the whole extent of the anterior opening of the nares will be exposed. If the uncut portion of the septum prevents the turning back of the nose, it should be divided with scissors. When the operation is finished, the wound should be carefully cleansed, the blood and clots being washed away with water; the lip is then replaced, and union takes place without any sutures being required." [1]

It is sometimes, however, necessary to open the nasal cavity from the face. This may be partially done by slitting the nostril in the middle line from below up to the lower edge of the nasal bone. If this does not afford sufficient space, the skin incision should be prolonged to the root of the nose, and the nasal bones separated from each other in the middle line with scissors or bone-forceps ; the whole side of the nose, consisting of the nasal bone, the os unguis, the nasal process of the upper jaw, with the lateral and alar cartilages, can now be pressed outward upon the cheek and held there by an assistant, while the surgeon examines the attachments of the growth and attempts to remove it through the gap thus formed. As Roser [2] says, "operations of this kind are rendered more easy by the fact that the patients are young, and their bony sutures soft, yielding, and easily dislocated."

Langenbeck's operation, which is practised by many surgeons, is done in the following manner: The patient lying on his back, an incision is carried from the junction of the nasal and frontal bones downward along the middle line of the nose to the upper margin of the alar cartilage, from which point a second incision is made outward along the upper edge of the cartilage of the affected side. The triangular flap thus formed is dissected back, care being taken to avoid injuring the periosteum. The cartilage is next severed from the bone and the os nasi separated from its fellow with bone-forceps. Part of the nasal process of the superior maxillary should then be separated from the body of the bone, the line of section being kept to the inner side of the orbital ridge, in order to avoid injuring the lachrymal canal. The quadrilateral osseous plate thus marked out is now connected with the frontal bone only by the natural suture and by the periosteum and mucous membrane, and it should be forced upward with an elevator so as to lay open the upper part of the nasal cavity. When the operation has been completed it is recommended that the wound should be kept open for some months in order that any recurrence of disease may be at once observed. MacCormac [3] has performed a similar operation on both sides, but he carried the vertical incision down the cheek instead of along the middle line of the nose.

Chassaignac's operation consists in loosening the attachments of the nose on one side, so as to allow of its being turned over on the opposite cheek. The following are the steps of the procedure: A transverse incision is made across the root of the nasal prominence, from the inner

[1] This operation has been done several times in England, but chiefly for the purpose of removing diseased bone from the nasal cavity. See in particular one very successful case by Harrison Cripps in Lancet, May 5, 1877, p. 643 et seq.

[2] Quoted by Spillmann: Dict. Encyclop. des Sciences Médicales, 2e série, t. xiii., p. 131.

[3] St. Thomas' Hospital Reports, 1875, p. 65 et seq.

angle of the orbit on the right side to the corresponding point on the left; a second cut is next made from the left extremity of the first incision to the outer margin of the left ala at its lower part; lastly, the knife is carried across the upper lip close under the nose to the external edge of the right ala. The nasal walls are now drilled through in the direction of the first incision, and, a chain-saw having been introduced through the aperture thus made, the upper part of the nasal processes of the superior maxillaries and the ossa nasi are divided from behind forward. The saw is then carried downward in the direction of the second incision, cutting through the osseous wall on the left side, while the septum and the bones on the right are snipped through with scissors or cutting forceps. Care must be taken not to injure the skin or soft tissues on the right side, as it is on the integrity of these that the vitality of the feature depends when it is replaced. The nose, having been detached in this manner on three sides, can be turned over toward the right "like the lid of a snuff-box," leaving free access to the naso-pharyngeal cavity. When the tumor has been extirpated the parts are to be carefully replaced, and the edges of the wound accurately brought together with sutures.

Ollier's operation, which he calls "vertical and bilateral osteotomy of the bones of the nose," is performed as follows: An incision, somewhat resembling a horseshoe in outline, is made through the skin from the outer edge of the ala upward along one side of the nose to its root and down to the edge of the outer ala. The knife should be carried at once through all the soft tissues. The bones of the nose are next to be divided in the direction of the first incision with a fine Butcher's saw, held parallel to the plane of the patient's forehead, while the cartilages of the septum and alæ should be snipped through with scissors. If necessary, the two small internal nasal arteries must be tied. The nose can now be pulled down, leaving free access to the naso-pharyngeal cavity. When the growth has been removed, the nose is replaced, and the edges of the wound brought together with fine wire sutures. Ollier[1] points out that this procedure does not endanger the vitality of the nose, as its chief arterial supply is left intact. Union takes place very quickly, one patient having been able to blow his nose on the fourth day after the operation.[2] Ample room is afforded for the removal of the tumor, Ollier himself having removed one weighing more than six ounces and a half,[3] which he says is perhaps the largest naso-pharyngeal fibroma that has ever been removed. He[4] is careful to point out, however, that all noses are not equally suitable for this operation, the long narrow ones being especially unfavorable, and generally rendering it necessary to sacrifice the turbinated bones. When the tumor is at all large, however, the pressure of the mass usually dilates the nasal passages much beyond their normal width, which makes the operation easier and more effectual.

A somewhat analogous method was carried out more than twenty years ago by Lawrence,[5] who, however, loosened the nose from below, leaving it attached only at the root, so that it could be thrown upward on the brow. He made a cut from the inner edge of each lachrymal sac downward along the naso-labial furrow to the point of junction of the septum with the upper lip, where the two incisions met. The bones of the nose and the

[1] Bull. de la Soc. de Chir., 1866, p. 264. [2] Ibid. [3] Ibid.

[4] Traité expér. et clin. de la Régénération des Os, Paris, 1867, t. ii, p. 484.

[5] Med. Times and Gaz., 1862, vol. ii, p. 491. Lawrence's operation was undertaken for the removal of mucous polypi.

septum were then divided from below with forceps, and the whole feature thrown upward. The nose was afterward replaced, and fixed with sutures. Union took place in a few days. The only disadvantage of this plan, as compared with Ollier's, is that the pedicle of the displaced mass is less vascular, and gangrene is, therefore, more likely to take place.

A procedure which may fitly be classed under the head of nasal operations was proposed and carried into execution almost at the same time by two Italian surgeons, Palasciano[1] and Rampolla.[2] This may be briefly described as follows: A small incision is made to the inner side of the lachrymal sac, which should be partly dissected out and held aside by an assistant; the inner wall of the tear-duct, formed by the *os unguis*, is then pierced with a curved trocar and canula, which is to be pushed into the nasal fossa by the superior meatus. The trocar is next withdrawn, and the canula is twisted so that its concavity looks upward and passes into the pharynx. Through it a ligature is then passed, which is made to encircle the tumor. The results of the operation have not been brilliant, one of the four cases in which it has been practised having ended fatally, while in another abscess of the eyeball ensued, and in the remaining two the growth speedily recurred. The plan has been tersely described by Robin-Massé[3] as simple ligation, applied in the most inconvenient way possible.

Maxillary Operations.—These consist of excision, and temporary resection of the superior maxillary bone. The history of these procedures has been already given (p. 349 et seq.).

The superior maxillary bone may be removed in its entirety, or partially, or it may be temporarily displaced. Excision of the upper jaw is done in the following way: A cut is made from the inner canthus along the side of the nose and carried through the whole thickness of the upper lip at its middle part; it is sometimes necessary to make a second incision from the upper extremity of the one just described, horizontally outward, about half an inch below the lower margin of the orbit to the malar prominence. Although this second cut is required for removing the superior maxilla when a large tumor springs from any part of that bone itself and causes considerable projection of the cheek, it can generally be dispensed with when the excision is performed for a naso-pharyngeal growth, and thus a very unsightly cicatrix can be avoided. The remainder of the operation cannot be better described than in the words of Heath:[4] "The skin having been reflected in the manner described above, the incisor teeth of the side to be removed are extracted, and a narrow saw with movable back is passed into the nostril. With this the alveolus and hard palate are divided, and the small saw is then applied to the malar process of the maxillary bone (or, if need be, to the malar bone itself), and to the nasal process of the superior maxilla, so as to notch both these points of bone, the division being completed with the bone-forceps. With the 'lion-forceps,' devised by Sir William Fergusson for the purpose, the jaw can be now grasped and broken away from the pterygoid process and the palate bone, any detaining point being severed with the bone-forceps. Lastly, when the bone is quite loose, the infra-orbital nerve is to be divided, and the soft palate dissected off the bone so as to leave as much as possible of it uninjured." Hemorrhage should be controlled by means of ligatures or the actual cautery, and at the conclusion of the operation the edges of

[1] Moniteur des Sciences, August 25, 1860, p. 393.
[2] Bull. de la Soc. de Chir., March and May, 1860.
[3] Op. cit, p. 60.
[4] Diseases and Injuries of the Jaws, London, 1872, second edition, pp. 275, 276.

the wound should be brought accurately together with harelip pins and the interrupted suture.

A method of partial and temporary resection, as already mentioned, was proposed and carried out by Huguier, in the following manner: A transverse slit having been made in the soft palate, a thread is carried through one nostril by means of Bellocq's sound, and brought out through the wound in the palate; to the end of this thread is fastened a string, which is to serve for making traction on the loosened piece of bone in the way to be presently described. An incision is next carried through the whole thickness of the cheek, from the corner of the mouth to the anterior border of the masseter; a second cut is then made from near the inner corner of the eye, along the genio-nasal furrow, detaching the ala of the nose, and ending in the middle of the upper lip. This triangular flap is dissected back and thrown outward. The saw is afterward to be carried horizontally through the upper jaw from immediately above the maxillary tuberosity to just above the floor of the corresponding nasal fossa. The first incisor of the opposite side should be displaced with the elevator, and the floor of the nose sawn from before backward, but not completely through. The base of the pterygoid process should next be cut through with bone-forceps, thus leaving the lower portion of the superior maxilla separated from the bones of the face, and only connected to them by the mucous membrane covering the palatine vault, which was spared in the division of the floor of the nose. With the forceps used as a lever, traction being at the same time made on the separated portion of bone by means of the string previously passed through the nose and the soft palate, the lower part of the upper jaw can be dislocated into the mouth. The nose and naso-pharynx are now fully exposed, and after the growth has been removed, and the bleeding stopped, the loosened maxillary bone should be replaced, gags should be put between the molar teeth on each side, the wound closed with harelip pins, and a bandage passed round the chin and fastened over the top of the head. Considerable trouble is sometimes caused by the displaced fragment not uniting and showing a tendency to fall into the mouth. Huguier, however, secured perfect union by means of a gutta-percha splint, carefully moulded to the alveolar border, and worn for a month or two; he states that the disfigurement left by the operation was slight.[1]

A procedure has been invented by Cheever[2] for the partial resection of *both* upper jaws, of which the following are the steps: An incision is made from the inner canthus through the soft parts on either side, and carried downward along the genio-nasal furrow to the middle of the lip. These flaps are next to be dissected back as far as the malar prominences. The body of the superior maxillary must then be cut through with a narrow saw, the line of division passing from the tuberosity forward under the zygoma into the middle meatus on each side. Lastly, the septum and the alæ should be snipped through with scissors. The upper jaw, which is now attached only at the back part, is to be forced downward, and the growth removed. The bone is then put back into its place, and firmly fixed in position by wire sutures passed through the malar bones on each side. Cheever claims for this plan that the vascular supply of the bone is not in-

[1] Robin-Massé, however, states (op. cit., p. 86), that from an examination of the patient, made a considerable time afterward, it appeared that the bone had never firmly united, and that all the teeth growing from it were carious, so that the replaced maxillary simply served as an indifferent obturator.

[2] Boston Med. and Surg. Journ., 1874, vol. xc., p. 547.

terfered with, since the palatine arch and the alveolar border are left uninjured.

A case which is probably altogether unique has been recorded by Ollier,[1] in which he performed temporary resection of an upper jaw of new formation. He had removed the superior maxillary more than three years previously in order to gain access to a naso-pharygneal polypus. When the patient again presented himself, a solid bony bridge was found joining the malar bone to the anterior nasal spine. This was divided at each of the points named, and raised, being afterward replaced when the growth had been extirpated. Union was complete in thirty days.

Palatine Operations.—Division of the soft palate was, as already stated, performed by Manne as a "preliminary operation" for the removal of a naso-pharyngeal polypus. He gives a very meagre description of his procedure, but appears to have divided the velum in its whole length near the middle line, cutting from below upward with a curved bistoury. This method was subsequently practised by Petit,[2] Morand, Nannoni, Ansiaux, Dieffenbach and others. Levret proposed the division of the pillars of the fauces on each side, with the view of making the curtain of the soft palate more movable. Jobert [3] appears to have modified this plan by incising the velum, beginning at the base of the pillars on each side, and cutting upward as far as seemed necessary. Maisonneuve [4] improved Manne's operation by leaving the lower edge of the velum undivided. He made a longitudinal incision through the soft palate, commencing close to the posterior edge of the palate bone, and carrying the knife to within 1 ctm. of the edge of the velum. This aperture he calls the "palatine button-hole." The finger is passed through it to explore the shape and attachments of the growth, which is then drawn through the "button-hole," the sides of which are very elastic. Round the sort of pedicle formed in the mass by this procedure a wire noose is placed, and pushed as far back through the velum as possible; it is then tightened, and kept in position till the tumor is cut through. Huguier [5] used a transverse "button-hole" in connection with his method of temporary resection of the upper jaw, and Bégin [6] employed this method in combination with division of the nose in front. Adelmann [7] also practised it as a part of an extensive operation for the removal of a growth which had depressed the hard palate and caused perforation of the bone in the middle. Nélaton [8] subsequently proposed trephining of the hard palate combined with division of the velum as a means of reaching the tumor to be extirpated, and of watching for any sign of recurrence after removal of the mass. His plan of procedure is as follows: The soft palate is divided, from its bony attachment to its free border, the cut being carried through the middle of the uvula. This incision should then be prolonged through the tissues covering the hard palate for the posterior half of its extent. From the anterior end of this cut two others should be carried outward and slightly backward on each

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[1] Traité expér. et clin. de la Régénération des Os, Paris, 1867, t. ii., pp. 492, 493.
[2] Quoted by Garengeot: Traité des Opérations de Chirurgie, Paris, 1731, t. iii., p. 51.
[3] Gazette des Hôpitaux, July 22, 1858.
[4] Gazette Hebdomadaire, September 2, 1859.
[5] Bull. de l'Acad. de Méd., May 28, 1861.
[6] Nouveaux Éléments de Chir. et de Méd. Opér., Paris, 1838, t. ii., p. 586 et seq.
[7] Untersuchungen über krankhafte Zustände der Oberkieferhöhle. Dorpat und Leipzig, 1844.
[8] Botrel: D'une Opération nouvelle dirigée contre les polypes naso-pharyngiens, Thèse de Paris, 1850.

side. These incisions should be made with a strong sharp knife, so as to cut through the periosteum and reach the bone. The posterior layer of the velum being next divided with the bistoury, the soft parts should be raised from the bone, and the two flaps thus formed should be held aside by assistants. The hard palate should be bored through with a perforator at the front part of the space thus exposed, the holes being made at about one centimetre from the middle line. Into these holes the blades of a pair of fine bone-forceps are then inserted, and the intervening portion of the palate is broken through, the separation of the osseous plate being completed, if necessary, by dividing the bone on each side.[1] The fragments of bone, which generally include part of the vomer, should be carefully detached from the mucous membrane, so as to allow of subsequent repair. Through the opening thus made the polypus is removed in whatever way the surgeon may prefer, the wound being subsequently kept open as long as may be desired in order to allow of thorough destruction of the roots of the growth, and the immediate treatment of any recurrence. Botrel[2] suggested Maisonneuve's "button-hole" method in combination with Nélaton's trephining of the hard palate as affording more hope of ultimate perfect healing of the wound.

The great danger of hemorrhage, both during the "preliminary operations" and the actual ablation of naso-pharyngeal fibromata, has been already mentioned, and it now only remains to make a few remarks on the best way of meeting these complications. It is most important to proceed with deliberation, securing the vessels, if possible, as they are divided; and it has been pointed out by Spillmann[3] that it is very desirable not to attack the polypus till the patient has recovered from the anæsthetic, so that he may be able to expectorate any blood which may flow into his trachea. In some cases it may be well to perform tracheotomy and use Trendelenburg's instrument (vol. i., p. 377) before the "preliminary operation" is commenced, but one case[4] proved fatal in spite—possibly in consequence—of previous laryngotomy. Tying the carotid is seldom of any use unless it has been found beforehand that pressure on the vessel will stop the blood; and in very severe cases the actual cautery is more to be relied on. Ollier plugs the naso-pharyngeal space with sponges after the operation, and this plan is generally adopted by English surgeons.

Notwithstanding all precautions, however, fatal syncope sometimes occurs after removal of these growths, probably owing to the sudden withdrawal of a large mass of blood from the immediate neighborhood of the brain.[5]

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[1] This operation is not so difficult in actual execution as may appear from the description. When the bones are pressed on by a polypus, they are usually so atrophied as to make it an easy matter to break or perforate them. Ollier (Traité exper. et clin. de la Régénération des Os, Paris, 1867, t. ii., p. 487) mentions a case in which the hard palate was so thin that it could be pierced with an ordinary pin.

[2] Loc cit.

[3] Dict. Encyclop. des Sciences Médicales, t. xiii., p. 150.

[4] Ratton: Lancet, November 3, 1878.

[5] Pozzi's experiments on dogs (Gaz. Hebd., September 4, 1874, p. 576) clearly show that death is more rapidly caused by the escape of a comparatively small amount of blood from the carotid artery than by the withdrawal of a much larger quantity from the femoral.

FIBRO-MUCOUS POLYPI OF THE NASO-PHARYNX.

These tumors vary in size from a pigeon's to a hen's egg, and are generally smooth, dark red, and more or less ovoid in form. Though certainly rare, they are more common than true fibromata in this situation. I have notes of only seven cases, though I have seen two or three others. The *symptoms* to which they give rise are principally those proceeding from nasal obstruction, but occasionally they cause deafness. They do not lead to hemorrhage, nor do they tend to destroy the bones with which they come in contact; and these points will serve to establish a *diagnosis* between such growths and true fibromata.

The *pathology* of these tumors has been rendered interesting by the researches of Panas,[1] who has shown that the mucous membrane round the posterior nares, and in the immediate neighborhood of these orifices, presents a kind of transitional form between the mucous membrane of the nasal fossæ, and the dense closely adherent fibro-mucous lining of the pharyngeal vault. Growths in these situations are composed, to a great extent, of the structural elements of the tissue from which they originate, and while a polypus springing from the pituitary membrane may be expected to be of mucous texture, one from the under surface of the basilar process is likely to be fibrous, and a tumor taking origin from the membrane round the posterior nares, where the fibrous and mucous elements are mingled, will probably present a corresponding fibro-mucous structure. This observation, however, must not be interpreted as being the statement of an absolute law, for as has been already seen, polypi of purely fibrous structure may be found within the nasal fossæ, and, on the other hand, growths of genuinely fibro-mucous character have been seen arising from near the roof of the pharynx. In those cases in which the tumor has branches extending both into the pharynx and into the nasal fossæ, the pharyngeal part is, as a rule, altogether fibrous, while the nasal offshoot is mucous in character. Panas[2] himself, who had been led by his anatomical investigations to conjecture that such mingled forms of polypi would be found in the naso-pharynx, met with an example in 1865. The patient was a man, aged sixty-eight, who had suffered from obstruction in the left nostril for three years. On examination by anterior rhinoscopy only a small reddish protuberance could be seen far back in the cavity, but on looking into the mouth, the soft palate was seen to be pushed down by a tumor of whitish apppearance. This was found to be extremely hard to the touch, and to be distinctly pedunculated. Panas divided the velum, and removed the polypus with scissors, having previously twisted the pedicle to prevent hemorrhage. The growth was round, smooth, and of fibrous appearance, both externally and on section, except the part that had blocked up the nostril, which was mucous in structure. In another instance recorded by Panas[3] the patient was a woman, aged twenty-six, who had suffered from obstruction of both nostrils for two years. Nothing could be seen by anterior rhinoscopy, but with the finger passed up behind the soft palate, a somewhat hard, pedunculated, and movable tumor was found hanging from the posterior nares into the pharynx. This mass was removed in the same manner as in the previous case, and it was found to consist of two polypi, each attached by a pedicle to the

[1] Bull. de la Soc. de Chir., 1873. The original statement, according to the author, was made in 1858, but he gives no reference. [2] Ibid., p. 378 et seq. [3] Ibid.

posterior edge of the vomer. Each tumor closed one posterior orifice like a lid, and part of the larger one of the two rested on the soft palate. They were reddish in color, in density intermediate between a fibrous tumor and a myxoma, and on section a certain quantity of serosity escaped. In addition to these, Mathieu[1] has collected four cases belonging to Legouest, Bonnes, Duménil, and Trélat, in which growths originating from the base of the skull were apparently of a fibro-mucous character, but in only one of these instances was the structure accurately determined by microscopic examination. In two other cases[2] (viz., those of Trélat and Labbé), where the growths originated from the upper part of the posterior nares, careful examinations by Cornil and Coyne proved that the polypi were of truly fibro-mucous character.

The *prognosis* is very favorable, as fibro-mucous polypi show but little tendency to recurrence after removal. The *treatment* should be to extirpate the polypus by the most suitable operation that offers itself. I have generally effected a cure by evulsion with forceps introduced through the mouth, as that is the readiest and most efficient method; but in some cases a wire can be passed through the nose round the pedicle, and in others the tumor can be attacked in the naso-pharynx by electric cautery. For this purpose Lincoln's post-nasal electrode (Fig. 61, p. 191) will be found very useful. Of the seven cases that I have met with, I succeeded in curing five; in one instance the disease recurred, but I heard that the patient was afterward cured by another practitioner. The seventh case was lost sight of, and its ultimate result is unknown to me. Severe "preliminary operations," such as are usually necessary for the removal of fibrous polypus of the naso-pharynx, are never required in the case of the growths now under consideration.

ENCHONDROMA OF THE NASO-PHARYNX.

A CASE of true cartilaginous growth springing from the basilar process of the occipital bone has been reported by Max Müller.[3] From the history of the case it appears that the patient, a man aged twenty-four, had noticed some obstruction in his nose five or six years before he came under observation. As the malady progressed he began to suffer from excruciating pain, together with frequent drowsiness, and occasional loss of consciousness. The growth increased in size, pressing the soft palate downward, completely filling both nostrils and displacing the nasal septum. The pressure of the mass produced absorption of the *lamina papyracea* of the ethmoid, and the tumor extended into the orbit. Müller removed the growth with a wire loop, having first performed temporary resection of the nose according to Langenbeck's method. The tumor, which was found to be attached to the basilar process, was of the size of a man's fist, and weighed about four ounces. It was proved by microscopic examination to be of truly enchondromatous nature.

This is the only instance, so far as I am aware, in which a cartilaginous growth is stated to have originated within the naso-pharyngeal cavity. Two cases, however, are on record in which a tumor primarily fibromatous in constitution is said to have become wholly or in part transformed into

[1] Sur les Polypes muqueux des Arrière-narines, Thèse de Paris, 1875. [2] Ibid.
[3] Langenbeck's Archiv f. klin. Chirurg., 1870, Bd. xii., p. 323.

cartilage. In one of these the patient was a boy, aged twelve, who died while under the care of Samuel Cooper.[1] The face was shockingly disfigured, the nose being bulged out on the left side to an extreme degree, and the eyes being four inches apart. The pharynx was so filled with the tumor that feeding even with the help of a spoon was most difficult, and it was impossible to examine the hard palate. The left eye had been completely blind for some time; and a week or two before the patient's death paralysis of the legs and bladder came on. At the autopsy "a good deal of the tumor was found to be of a cartilaginous consistence." A piece almost as large as an orange had penetrated the skull and destroyed the anterior lobe of the left hemisphere of the brain. All the neighboring bony structures had been more or less absorbed, so that it was impossible to discover the point of origin of the tumor. A most remarkable feature in this case is that, in spite of such extensive cerebral lesions, the patient had felt no pain, and had not lost consciousness till the last moments of life. The second case is that of a boy, seventeen years of age, who had suffered for some time from the usual symptoms of naso-pharyngeal polypus. He was operated on by Le Dentu [2] according to Nélaton's palatine method, and the growth, which was found to spring from the basilar process, and presented all the naked-eye appearances of a fibroma, seemed to be completely destroyed. Recurrence, however, took place within a twelvemonth, and Le Dentu performed a second operation, this time gaining access to the tumor by laying the nose open from the front. In this manner he removed a *cartilaginous* growth as large as a date, which was attached to the posterior edge of the vomer, and sent branches into each nasal fossa. Behind this, and connected with it, was another *cartilaginous* mass, which seemed to be attached to the base of the skull. It was not judged safe, however, to meddle with this portion of the growth. The patient appears to have made a good recovery, but the ultimate issue of the case is not stated. With reference to the nature of the tumor in this instance, it is to be noted that no microscopic examination was made of the mass removed at the first operation. It is therefore at least possible that it may have been of enchondromatous nature from the outset. Petit [3] suggests that the transformation may have been due to irritation of the neighboring osseous tissue. The fact, however, that no such sequence of events has been observed in similar cases makes this hypothesis somewhat difficult of acceptance.

MALIGNANT TUMORS OF THE NASO-PHARYNX.

Cases of malignant disease, in this situation, were mentioned without any details by Otto Weber,[4] and instances have since been related by Verneuil,[5] Rabitsch,[6] Gross,[7] Demarquay,[8] and Bryk,[9] while a short mono-

[1] Dict. of Practical Surgery, edited by Lane, London, 1872, art. Polypus, vol. ii., p. 463.

[2] Petit: De quelques Considérations sur les Polypes naso-pharyngiens, Thèse de Paris, 1881, p. 32 et seq.

[3] Op. cit., p. 34.

[4] Pitha u. Billroth: Chirurgie, Bd. iii., 1. Abtheil., 2. Heft. Erlangen, 1866.

[5] Bull. de la Soc. de Biologie, Paris, 1869.

[6] Allgem. Wien. med. Zeitung, 1869, No. 42.

[7] Gazette Méd. de Strasbourg, 1872, No. 2.

[8] Bull. de la Soc. de Chir., June 18, 1873.

[9] Arch. f. klin. Chirurg., Bd. xvii., 4 Heft, p. 562.

graph on the subject has been published by Veillon.[1] The *causes* of such growths are utterly unknown, and the disease itself does not appear to be very common. The rarity of the complaint, however, is probably not so great as might be inferred from the extremely small number of recorded cases, the affection, no doubt, having in some cases been mistaken for simple fibrous polypus. In certain rare instances a growth of the latter kind may gradually become transformed into genuine sarcoma.[2]

The *symptoms* are those characteristic of all tumors which obstruct the nasal channels, viz., an annoying sense of impeded respiration, which may gradually increase to actual dyspnœa, occasional epistaxis, more or less constant coryza, post-nasal catarrh (the secretion being often extremely fetid), alteration of voice, and imperfect articulation. Great pain is a frequent, but by no means invariable accompaniment of malignant tumors in the naso-pharynx; it is often described by the patient as "shooting through the ear," and is, as a rule, most troublesome at night. As the tumor increases, dysphagia may be produced, and finally general cachexia may supervene. Anterior rhinoscopy will probably show that there is an obstructing mass in one or both of the nasal channels, and a careful use of the probe will enable the surgeon to ascertain whether this substance is attached to the septum or any other part of the fossa. On looking into the mouth the velum will probably be seen to be dense, and perhaps bulged forward at one part; if the tumor is of considerable size part of it may be visible on drawing aside or raising the soft palate. Sarcomatous tumors of the naso-pharynx are not unfrequently pedunculated and somewhat pyriform in shape, while occasionally they are more or less distinctly lobulated. They are covered by the mucous membrane of the pharynx, and present no special features by which the eye or the touch can detect their true nature. These tumors have the usual characteristics of malignancy, viz., rapidity of growth, recurrence after removal, and in many cases a disposition to form secondary deposits in other organs. The *diagnosis* can seldom be made with certainty except by microscopic examination. A very practised and delicate sense of touch might possibly enable the surgeon to distinguish the moderate density of a sarcoma from the extreme hardness of a true fibroma. Tactile investigation, however, is a most untrustworthy guide in such cases, as it has to be exercised under difficult conditions, and, moreover, the structure of tumors in the naso-pharyngeal region is seldom uniform throughout the whole mass, both fibrous and sarcomatous growths having frequently a certain admixture of mucous tissue. The *prognosis* in cases of malignant growths of the naso-pharynx is altogether hopeless. As regards the *pathology* of such tumors, they appear to be mostly of sarcomatous nature. They often, however, present a considerable amount of mucous or fibrous tissues, in addition to the characteristic round or spindle-shaped cells; and it is possible that in such cases the malignant growth may have supervened on what was originally a mere hyperplasia. Sometimes, as in cases recently reported by Thornley Stoker[3] and McDonnell,[4] cartilage-cells are contained in the tumor. If the disease be met with in an early stage the *treatment* should consist in the entire removal of the mass with the snare or electric cautery. In most cases a

[1] Contribution à l'Étude des Tumeurs malignes naso-pharyngiennes, Thèse de Paris, 1875.

[2] Otto Weber: Op. cit., p. 207. See particularly Fig. 37 (ibid.), which is a representation of a naso-pharyngeal fibrous polypus that had undergone sarcomatous degeneration. [3] Brit. Med. Journ., January 19, 1884, p. 113. [4] Ibid.

"preliminary operation" (p. 360) will be necessary to expose the tumor. The surgeon should carefully watch for any signs of recurrence, in order that he may at once attack the disease again, if necessary; but the best that can be done is often merely to prolong a miserable existence.

THROAT-DEAFNESS.

Definition.—Deafness caused by morbid conditions in the naso-pharynx near the orifice of the Eustachian tube, or by changes in the walls of the tube itself, which interfere with the free passage of air to the tympanic cavity.

History.—Many of the older writers have mentioned that deafness may be caused by mechanical obstruction of the pharyngeal orifice of the Eustachian tube, or inflammation of its interior, resulting from syphilitic disease. Thus Valsalva [1] speaks of deafness arising from obliteration of the tube by ulceration of specific origin. Van Swieten [2] describes the extension of venereal ulceration from the pharynx along the Eustachian tube to the internal ear, and Plenck [3] mentions stricture of the tube dependent on the same cause. Similar observations were made by Nisbet,[4] B. Bell,[5] Swiedaur,[6] Saunders,[7] and Cullerier.[8] The actual term "throat-deafness" was first employed in comparatively recent time, and was applied to a form of deafness which was supposed to be due to enlargement of the tonsils. This view was strongly insisted on by Yearsley [9] in 1853, but was successfully combated by Harvey,[10] who showed on anatomical grounds that it is impossible for the Eustachian orifice to be blocked up in this way, and suggested that the affection might be due to an extension of the inflammation of the mucous membrane covering the tonsils to the contiguous lining of the Eustachian tube. This theory soon gained general acceptance, and nearly all cases of throat-deafness were looked upon as examples of catarrh of the middle-ear, originating in the naso-pharyngeal region. From the more accurate knowledge gained in late years, however, throat-deafness has come to be attributed to various other diseased conditions of the Eustachian tube. In 1862 Hinton [11] distinguished two forms of throat-deafness, one dependent on inflammatory thickening of the palato-pharyngeal region, the other on *relaxation* of those parts. The recognition of the importance of adenoid growths in the naso-pharynx as a frequent cause of deafness by Meyer [12] in 1869, marks an epoch in the history of throat-deafness. In 1873 a most important work was published by Weber-Liel,[13] who brought forward a considerable amount of evidence to show that what had hitherto been looked upon as a catarrhal affection of the Eustachian tube and middle ear was in fact a neurosis, the chief feature of the complaint being paralysis of the tensor palati—the muscle mainly concerned in maintaining the patency of the Eustachian canal. According to Weber-Liel the paralysis of this important muscle leaves the tensor tympani unbalanced, a condition producing many evils, which will presently be referred to. In 1879 Woakes [14] described at the annual meet-

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[1] De aure humanâ, Bologna, 1704, p. 90.

[2] Comment. in H. Boerhaave Aphorismos, Lugd. Batav., 1772, t. v., pp. 369, 371, 373.

[3] De morbi venerei doctrinâ, Viennæ, 1779, p. 89.

[4] First Lines of the Theory and Practice of Venereal Disease, Edinburgh, 1787, p. 330.

[5] Treatise on Gonorrhœa, Edinburgh, 1793, vol. ii., p. 65 et seq.

[6] Traité de la Maladie vénérienne, Paris, 1801, t. ii., p. 144.

[7] Anatomy of the Human Ear, etc., London, 1806, p. 79.

[8] Journ. de Médecine, 1814, t. xlix., p. 202.

[9] Throat-Deafness, London, 1853, first edition, p. 2 et seq.

[10] The Ear and its Diseases, London, 1856, p. 157.

[11] Holmes' System of Surgery, London, 1862, first edition, vol. iii., pp. 159–162.

[12] Med.-Chir. Trans., 1870, vol. liii., p. 192 et seq.

[13] Ueber das Wesen u. die Heilbarkeit der häufigsten Form progessiver Schwerhörigkeit. Berlin, 1873.

[14] Brit. Med. Jour., 1879, vol. ii., pp. 328, 329.

ing of the British Medical Association a form of throat-deafness in which both the tubal muscles and the tensor tympani are paralyzed.

Etiology.—The disease may depend on a paretic condition of the Eustachian tube, on chronic inflammatory thickening of its lining membrane, or on any morbid state of the naso-pharynx which gives rise to obstruction of the Eustachian orifice. These three factors in the production of throat-deafness will now be considered in detail.

In the nervo-muscular cases the immediate cause of the affection seems to be paralysis of the tensor palati, a lesion which, according to Weber-Liel, may be either central, reflex, or vasomotor in its origin. The impaired contractility of the tube most frequently results from morbid conditions of the fifth nerve, but in like manner, neuroses of the facial, glosso-pharyngeal, vagus, and spinal accessory, and of the sympathetic plexuses in the naso-pharynx and neck may lead to atrophy and fatty or fibrous degeneration of the muscles. The remote causes of these nervous affections are usually mental strain, depressing emotions, excessive exertion, parturition, and, speaking generally, all unhealthy modes of life. Weber-Liel's work contains examples of throat-deafness following phthisis and typhoid fever. Diphtheritic affections of the naso-pharynx would, of course, be likely to lead to disease of the Eustachian tube and middle ear, and that this complication is not uncommon may be inferred from the fact that Wendt [1] found the middle ear involved in two-fifths of the cases in which there was false membrane in the naso-pharynx. Rheumatism, progressive muscular atrophy, chlorosis, and even extreme anæmia may likewise impair the muscles. Weber-Liel is of opinion that paresis is sometimes favored by congenital defect in the development of these muscles.

Chronic inflammation of the Eustachian tube sometimes follows catarrh of the naso-pharynx, but it must not be forgotten that catarrh is extremely likely to occur in parts whose innervation is impaired, and that in many cases of catarrhal affection of the middle ear, the neurosis has been the starting-point. According to Zaufel,[2] however, dry catarrh frequently brings on deafness by extension of the unhealthy condition to the Eustachian tube. He states that he found this complication in as many as eighty per cent. of the cases of ozæna which he had examined. I have not myself met with deafness in patients suffering from ozæna in anything like the same proportion, though I have occasionally found the two conditions coexistent.

The disease of the naso-pharynx which most frequently interferes with the Eustachian orifice is the presence of adenoid growths in that region. Among 175 patients suffering from these vegetations in the naso-pharynx, Meyer [3] found associated defect of hearing in 130. Syphilitic lesions may also occur in the neighborhood of the Eustachian tube, and lead to impairment of hearing by mechanical obstruction or inflammation of the canal. This, as already remarked, was noticed by several of the older writers. In recent years Zaufel [4] has called attention to the frequent occurrence of gummata in the immediate neighborhood of the Eustachian tube. Among more obscure forms of throat-deafness may be mentioned phlebectasis of the mucous membrane covering the Eustachian cartilage, which, according to von Tröltsch,[5] may narrow the lumen of the tube to a degree suffi-

[1] Ziemssen's Cyclopædia, vol. vii., p. 71.
[2] Die allgemeine Verwendbarkeit der kalten Drahtschlinge. Prag., 1878.
[3] Archiv für Ohrenheilkunde, 1874, Bd. viii., p. 243. [4] Loc. cit.
[5] Lehrbuch der Ohrenheilkunde, 1877, p. 310.

cient to diminish the power of hearing. Zuckerkandl [1] states that the veins of the internal pterygoid plexus may, if enlarged, produce the same effect by their pressure on the Eustachian cushion. Schwartze [2] asserts that œdema of the tubal prominences, and consequent partial occlusion of the Eustachian tube, may be caused by obstruction to the blood-current in the superior *vena cava*. The Eustachian canal is, in certain instances, blocked up by exostoses situated in the vicinity of the tube; von Tröltsch [3] found this condition produced in one case by hypertrophy of the posterior extremity of the inferior spongy bone, and in another by a bony outgrowth from the septum.

Symptoms.—Throat-deafness being dependent on so many different conditions, the symptoms vary considerably. The phenomena even in paretic cases differ greatly, one set giving rise to distressing symptoms, and tending to get worse in spite of all treatment, while the other causes much less inconvenience, and generally yields to remedial measures. The first class is that described by Weber-Liel. One of the earliest signs is *fatigue* in listening. It shows itself by the patient perceiving a difficulty in hearing, after a prolonged conversation, the auditory power being good at the commencement, but gradually failing as the strain continues. The patient finds it particularly difficult to hear when general conversation is going on, though he can do so with ease when one person is speaking alone. The difficulty in the former case arises from a loss of the "power of accommodation," the tympanum being unable to adapt itself readily to the different sounds caused by voices of varying quality and intensity, proceeding from persons situated at different distances and in different directions in relation to the listener. Together with this, noises are frequently perceived in the affected ear, while snapping sounds are heard by the patient in chewing and swallowing. As the disease advances, giddiness is sometimes felt. The patient often complains of an uneasy tickling or scratching sensation in the throat, and on inspection, paralysis of one or both sides of the pharynx may be noticed. Though Weber-Liel [4] first called attention to this paralysis, Woakes has rendered good service in insisting on the great importance of carefully examining the soft palate in every case of deafness in order to ascertain whether its innervation is normal. This examination is of the utmost importance in the cases here described, as the neurosis does not of itself attract notice, the paresis being seldom sufficiently severe to modify the patient's voice by giving it the peculiar intonation so characteristic of paralysis of the soft palate. On examining the ear the tympanum is often seen to be retracted, and sometimes opaque and thickened. Owing to the collapse of its walls the Eustachian tube cannot be inflated with Politzer's bag, but the catheter can be passed with ease.

The affection just described most frequently begins on the left side, and it shows great intractability. According to Weber-Liel the troublesome character of the symptoms is largely due to the unbalanced action of the tensor tympani, causing an intense strain on the drumhead and the ossicles. A much milder neurosis has been described by Woakes, in which, however, the innervation, both of the tubal muscles and the tensor tympani, is impaired. The obstruction of the Eustachian tube is only partial, for the two sets of muscles being alike affected, they balance each

[1] Monatsschrift f. Ohrenheilkunde, Jahrgang x., Sp. 52, p. 231.
[2] Pathol. Anatomie des Ohres, p. 104.
[3] Archiv für Ohrenheilkunde, Bd. iv., p. 140.
[4] Op. cit., pp. 33–36.

other exactly, and on examining the ear, the drumhead is seen to be normal or only slightly flattened. In these cases noises in the head and giddiness are not perceived, but the deafness is marked from the very commencement of the affection, which, however, shows a tendency to recovery.

Throat-deafness dependent on any of the morbid conditions of the naso-pharynx already described presents the symptoms of those affections with the addition of deafness.

Diagnosis.—A careful examination of the palate, the naso-pharynx, and the auditory canal will serve to determine whether the disease is Eustachian in its origin. The state of tension of the membrana tympani will enable the practitioner to discriminate between the different kinds of paresis, and it must not be forgotten that in the severer form structural disease of the middle ear is very apt to be set up.

Pathology.—The pathology of the various affections of the naso-pharynx, which may accidentally lead to obstruction of the Eustachian orifice, has been considered in its appropriate place, and it now only remains to make a few remarks on the paretic forms of throat-deafness. In the severer cases, through collapse of the tube the air in the tympanic cavity becomes unduly rarefied, while the tensor tympani being no longer balanced, tension of the tympanic membrane takes place, the chain of ossicles is put on the stretch, and the stapes is pressed into the labyrinth. Secondary changes soon follow: passive congestion of the tympanic cavity leads to trophic changes of a more or less cirrhotic character, consisting at first in the growth and afterward in the atrophy of a low form of connective tissue. Adhesion takes place between parts normally separate, the stapes becomes fixed in the fenestra ovalis, and the labyrinth becomes the seat of disease. As already remarked, Weber-Liel thinks that the starting-point of these serious changes may be either central, reflex, or vasomotor. The less severe complaint described by Woakes is, according to that physician, always of vasomotor origin. He believes that in such cases the nerve force, especially of the sympathetic system, is exhausted.

Prognosis.—In the nervous cases the age and condition of the patient must be taken into account. If the subject of the affection be a person worn out by disease, overwork, or anxiety the prognosis is very unfavorable. The tendency toward permanent loss of hearing is indeed so marked in this class of cases that Weber-Liel, who first described them, calls the affection "*progressive deafness.*" The presence of tinnitus must also always be a matter of serious import.

When the disease is due to adenoid growths a favorable prognosis may be given, as the vegetations can always be got rid of. In other cases of a mechanical nature the prospects of the patient must depend on the possibility of removing the cause of the obstruction.

Treatment.—The nervous cases should be treated in the early stage by inflation of the Eustachian tube by Politzer's method, if the tube responds to that treatment, and if not, by means of the catheter. Intra-tubal galvanism has been found useful by Weber-Liel in the commencement of the more severe type of the disease, and Woakes asserts that it is of very great service in the slighter cases. Von Tröltsch[1] maintains that the act of gargling, by exercising the palato-pharyngeal muscles, is often beneficial. In the later period of the disease, when secondary changes have taken place in the middle ear, nothing remains but the doubtful operation of paracentesis of the tympanum and tenotomy of the tensor tympani. Long

[1] Archiv f. Ohrenheilkunde, Bd. iv., p. 140.

before the complaint has reached this stage, however, constitutional treatment should have been carried out. The patient ought, if possible, to be relieved from worry and anxiety; if overworked he should diminish his labors or desist from them altogether and seek change of scene, while his system should be invigorated in every possible way. Nerve-tonics, especially phosphorus and strychnia, are useful is some cases, while for the anæmic, preparations of iron are more beneficial.

Where the disease depends on actual obstruction the cause must, if possible, be removed. Adenoid growths must be got rid of in the manner already indicated (p. 348 et seq.). Syphilitic webs and enlarged veins should, if possible, be destroyed with the electric cautery, œdematous swellings must be scarified, and exostoses, if they can be reached, should be broken off with curved forceps.

APPENDIX.

SPECIAL FORMULÆ FOR TOPICAL REMEDIES.

MOST OF WHICH ARE CONTAINED IN THE THROAT HOSPITAL PHARMACOPŒIA.

Those Formulæ which are printed in black (Clarendon) type have been found of especial use by the author.

FORMULÆ FOR INHALATIONS HAVE ALREADY BEEN GIVEN (VOL. I., pp. 419, 422), AND FOR LOZENGES (*Ibid.*, p. 423).

BUGINARIA.

MEDICATED bougies are useful in chronic affections of the nasal passages. The indications for the employment of the different kinds of buginaria will be gathered from their constitution. The basis of the bougie is "gelato-glycerine," which consists of gelatine, glycerine, and water, in the following proportions :

℞. Refined gelatine (by weight)..... ℥ v.
Glycerine (by weight)..... ℥ vj.
Water " ..... ℥ vj.

Soak the gelatine in the water for twelve hours, with occasional stirring, add the glycerine, dissolve in a water-bath, and evaporate to produce fifteen ounces by weight of the gelato-glycerine. In making bougies the

FIG. 93.—The Nasal Medicated Bougie.

gelato-glycerine must be melted, the medicament added, and the substance poured into moulds of such a shape that each bougie has a length of 8 ctm., and is of a tapering form (Fig. 93), the diameter of the larger end being 8 mm., and that of the smaller extremity 3 mm. The annexed woodcut shows the shape of the bougie as it is made in the mould.

When required for use it can, of course, be shortened or pared down if desired. The following may be taken as a typical formula:

℞. Iodoform, in fine powder ..... gr. ss.
Glycerine ..... ♏j.

Rub together, and add the mixture to

Gelato-glycerine, melted in a water-bath.... gr. xl.

Mix and pour into the mould. When solidified, remove for use.

Buginarium Acidi Carbolici (Acid. Carbol. gr. ss., Gelato-Glycerini, gr. xl.).

Buginarium Bismuthi (Bismuth. Subnitrat. gr. v., Glycerini ♏iij., Gelato-Glycerini gr. xl.).

Buginarium Cupri Sulphatis (Cupri Sulph. Pulverisati gr. $\frac{1}{10}$, Gelato-Glycerini gr. xl.).

Buginarium Iodoformi (Iodoformi Pulverisati gr. ss., Glycerini ♏j., Gelato-Glycerini gr. xl.).

Buginarium Morphiæ (Morph. Acetat. gr. $\frac{1}{10}$, Gelato-Glycerini gr. xl.).

Buginarium Plumbi Acetatis (Plumbi Acetat. gr. ss., Glycerini ℥ij, Gelato-Glycerini gr. xl.).

Buginarium Thymolis (Thymol. gr. $\frac{1}{10}$, Sp. Vin. Rect. ♏ ss., Gelato-Glycerini gr. xl.).

Buginarium Zinci Sulphatis (Zinc. Sulph. Pulverisati gr. $\frac{1}{10}$, Gelato-Glycerini gr. xl.).

COLLUNARIA—NASAL DOUCHES.

Not more than twenty ounces of fluid should ever be used for a nasal douche, and ten ounces are generally sufficient. If an apparatus on the siphon principle be employed, it should be placed just above the level of the patient's head, in order to avoid too great force of current.

The temperature of the fluid should be about 90° F.

Astringent.

Collunarium Acidi Tannici (Acid. Tannic. gr. iij., ad ℥j.).

Collunarium Aluminis (Aluminis gr. iv., ad ℥j.).

Collunariam Zinci Sulphatis (Zinc. Sulph. gr. ss., ad ℥j.).

Detergent.

Collunarium Acidi Carbolici cum Sodâ et Borace (Acid. Carbol. gr. iv., Sodæ Bicarb. gr xij., Boracis gr. xij., Aquæ ℥j.).

Collunarium Potassæ Permanganatis (Sol. Potass. Permang., B. P., ♏vj., Aquam ad ℥j.).

Collunarium Sodæ (Sodæ Bicarb. gr. xxx., ad ℥j.).

Collunarium Sodii Chloridi (Sodii Chloridi gr. xx., ad ℥j.).

Antiseptic.

Collunarium Acidi Carbolici (Acid. Carbol. Puri gr. iij., Glycerini ♏xx., Aquam ad ℥j.).

Collunarium Zinci Sulpho-Carbolatis (Zinc. Sulpho-Carbol. gr. ij. ad ℥j.).

LOTIONS—NASAL WASHES.

These lotions should be sniffed up into the nose from the hollow of the hand, or gently injected by means of a small glass or india-rubber syringe. The fluid should be made to transverse the whole length of the nasal fossæ till it trickles into the pharynx, when it must be spit out. The lotions should be used at a temperature of about 100° Fahr.

Detergent.

Lotio Alkalina (**Sodæ Bicarb. gr. xij., Acid. Carbol. gr. iss., Aquæ ℥ j.**).

Lotio Ammonii Chloridi Alkalina (**Sodæ Bicarb. gr. vj., Ammon. Chlorid. gr. vj., Aquæ ℥ j.**).

Lotio Potassæ Chloratis Alkalina (Sodæ Bicarb. gr. vj., Potass. Chlor. gr. vj., Aquæ ℥ j.).

Lotio Alkalina Composita (**Sodæ Bicarb., Sodæ Biborat., Sodii Chlorid. āā. gr. vij., Sacch. Alb. gr. xv.**).

The powder thus formed should be dissolved in about half a tumblerful of tepid water.[1]

Astringent.

Lotio Aluminis (Alum. gr. vj. or more, Acid. Carbol. gr. iss., Aquæ ℥ j.).

Lotio Ammonii Chloridi Astringens (**Ammon. Chloridi gr. vj., Aluminis gr. vj., Aquæ ℥ j.**).

Lotio Zinci Sulphatis (Zinc. Sulph. gr. vj., Acid. Carbol. gr. iss., Aquæ ℥ j.).

NEBULÆ—NASAL SPRAYS.

In using these the ordinary hand-ball spray-producer answers well. Besides a long tapering straight nozzle for the anterior part of the nasal fossæ, another, curved upward almost at a right angle about an inch and a half from the point, will be required for the posterior nares.

Antiseptic.

Nebula Acidi Carbolici (**Acid. Carbol. gr. iij., ad ℥ j.**).

Nebula Acidi Sulphurosi (Acidi Sulphurosi q.s.).

Forty to sixty drops should be used at a time. The spray should be inhaled very slowly.

Nebula Iodi cum Acido Tannico (**Tr. Iodi ♏iij., Glycerini Acid. Tann. ♏xij., Aquam Destill. ad ℥ j.**).

Nebula Iodoformi (**Iodoform. gr. xl., Ætheris, Sp. Gr. .735, ℥ j.**).

Nebula Potassæ Permanganatis (Potass. Permang. gr. v., Aquæ Destill. ℥ j.).

Nebula Sodæ Benzoatis (Sodæ Benzoat. gr. xx., Aquæ Destill. ℥ j.).

Nebula Zinci Iodati (**Iodated Zinc Caustic ♏ij. or more, Aquam Destill. ad ℥ j.**).

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[1] The author has constantly prescribed this lotion during the last few years for chronic inflammatory conditions of the nares and naso-pharynx, and with very satisfactory results.

Astringent.

Nebula Acidi Tannici (Acid. Tannic. gr. v., Aquæ Destill. ʒj.).
Nebula Aluminis (Liq. Alumin. Chlorid. ♏iij., Aquam Destill. **ad ʒj.).**
Nebula Aluminis (Alum. gr. viij., Aquæ Destill. ʒj).
Nebula Ferro-Aluminis (Ferro-Alum. gr. iij., Aquæ Destill. ʒj.).
Nebula Ferri Perchloridi (Ferr. Perchlor. gr. iij., Aquæ Destill. ʒj.).
Nebula Ferri Sulphatis (Ferr. Sulphat. gr. ij., Aquæ Destill. ʒj.).
Nebula Zinci Chloridi (Zinc. Chlorid. gr. ij., Aquæ Destill. ʒj.).
Nebula Zinci Sulphatis (Zinc. Sulph. gr. v., Aquæ Destill. ʒj.).

Detergent.

Nebula Alkalina (Sodæ Bicarb. gr. xv., Boracis gr. xv., Acid. Carbol. gr. iv., Glycerini ♏xlv, Aquam ad ʒj.)
And the following, which is alluded to in the body of the work as "Dobell's Solution."[1]

℞. Boracis..... ʒj.
Glycerini acidi carbolici..... ʒij.
Sodæ bicarbonatis..... ʒj.
Aquæ..... Oss.[2]

Nebula Potassæ Chloratis (Potass. Chlor. gr. xx., Aquæ ʒj.).
Nebula Sodii Chloridi (Sodii Chlorid. gr. v., Aquæ Destill. **ʒj.).**

Sedative.

Nebula Potassii Bromidi (Potass. Bromidi gr. xx. ad ʒj.).

Useful in Diphtheria.

Nebula Acidi Lactici (Acid. Lactic., U.S.P., ♏xxx., Aquam Destill. ad ʒj.).
Nebula Calcis (Aq. Calcis q.s.).
Nebula Sodæ Salicylatis (Sodæ Salicylatis gr. xx., Aquæ ʒj.).

GOSSYPIA MEDICATA—MEDICATED COTTON-WOOLS.

Nasal plugs of unmedicated cotton-wool have been used for some time by Gottstein in cases of simple ozæna with the happiest results. A full description of his method of applying them has already been given in the body of the work (p. 196 and p. 233). In cases of active inflammation or syphilitic ulceration affecting the interior of the nose or the naso-pharyngeal region, medicated wools, as proposed by Dr. Woakes, answer best, the remedy being by this means brought into direct and constant contact with the diseased part. The ingredients are first mixed together and dissolved, the wool is then to be saturated evenly with the solution and dried by exposure to the air with a moderate heat.

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[1] Winter Cough, London, 1875, third edition, p. 211.
[2] The water should be warm. Chloride of ammonium, chlorate of potash, or Condy's fluid may be substituted for the borax in the above formula.

Astringent.

Gossypium Acidi Tannici (Acid. Tannici gr. xxx., Glycerini ♏x., Aquæ ℥vj., Cotton-wool, in a thin sheet, gr. lx.).

Gossypium Aluminis (Alum. gr. xxx., Glycerini ♏x., Aquæ ℥j., Cotton-wool as above).

Gossypium Ferri Perchloridi (Liq. Ferr. Perchlor. ℥ss., Glycerini ♏x., Cotton-wool as above).

Gossypium Cubebæ (Tr. Cubebæ ℥j., Glycerini ♏x., Cotton-wool as above).

Gossypium Hamamelis (Tr. Hamamel. ℥ss., Glycerini ♏x., Cotton-wool as above).

Gossypium Krameriæ (Tr. Krameriæ ℥ss., Glycerini ♏x., Cotton-wool as before).

Antiseptic and Disinfectant.

Gossypium Acidi Boracici (Acidi Boracici gr. lx., Glycerini ♏xx., Aquæ ℥vj., Cotton-wool as above).

Gossypium Camphoræ (Camphoræ gr. xxx., Æther. Pur. ℥j., Cotton-wool as above).

N.B.—This wool should be prepared in a room where there is neither artificial light nor fire.

Gossypium Iodi (Tr. Iodi ℥ss., Glycerini ♏x., Cotton-wool as before).

Gossypium Iodoformi (Iodoformi gr. lxx., Æther. Pur. fl. ℥x., Alcoholis fl. ℥ij. Glycerini ♏x., Cotton-wool as before).

N.B.—This wool should be prepared in a room where there is neither artificial light nor fire.

Sedative.

Gossypium Opii (Tr. Opii ℥ss., Glycerini ♏x., Cotton-wool as above).

OLFACTORIA—OLFACTORIES.

These are dry inhalations of the nature of smelling-salts, and should be used in the same way, *i.e.*, a little cotton-wool or sponge should be saturated with the medicament and placed in a stoppered glass bottle. The remedy is to be sniffed up the nose.

The following is very popular in Germany, and has been alluded to in the body of the work (p. 202) as the Hager-Brand's "Anti-catarrhal Remedy."

℞. Acid carbolici,
Liq. ammon. fort. ..... āā ℥v.
Alcoholis ..... ℥ij.

To be kept in a dark place or in a tinted glass bottle.

PASTILS.

This is a soft variety of lozenge, somewhat resembling in appearance and consistence the "jujubes" sold by confectioners. The basis of the preparation is glyco-gelatine, a compound much employed in the manufact-

ure of pessaries and soluble bougies. Its adaptation to the present purpose was advocated by Dr. Whistler (*Med. Times and Gaz.*, November, 1878) as a means of applying iodoform to the throat, and as affording a ready method of prescribing lozenges to meet the requirements of individual cases. Pastils are especially suited to cases of inflammation of the tongue or palate, and their mucilaginous nature gives much relief in dryness of the throat. Their soft consistence renders them particularly useful in cases of œsophageal disease.

No substances, such as tannin, rhatany, or kino, which are chemically incompatible with gelatine, can be employed with the basis.

The following is the formula for the glyco-gelatine:

℞. Refined gelatine..... ℥ j.
Glycerine (by weight)..... ℥ iiss.
Ammoniacal solution of carmine..... q.s.
Orange-flower water..... ℥ iiss.

The process to be pursued in making the basis is as follows: Soak the gelatine in the water for two hours, then heat in a water-bath till dissolved; add the glycerine, and stir well together. Let the mixture cool, and when it is nearly cold add the carmine solution; mix till uniformly colored, and set aside to solidify. After medicating, as directed in the following formulæ, it is cooled by pouring into an oiled tray, and when solidified, cut into the required number of pastils. One ounce of the mass will make twenty-four.

The following is a typical formula, iodoform being taken as an example:

℞. Iodoform, in fine powder..... gr. j.
Glycerine..... ♏j.

Rub together and add the mixture to the

Glyco-gelatine (melted in a water-bath)..... gr. xviij.

Mix and set aside to cool, and make one pastil.

Antiseptic.

Pastillus Acidi Boracici (Boracic Acid, in fine powder, gr. ij.).
Pastillus Acidi Carbolici (Carbolic Acid gr. ss.).
Pastillus Iodoformi (Iodoform in fine powder gr. j., or more or less if prescribed).

Stimulant.

Pastillus Ammonii Chloridi (Chloride of Ammonium gr. ij.).
Pastillus Bismuthi (Carbonate of Bismuth gr. iij.).
Pastillus Bismuthi et Potassæ Chloratis (Carbonate of Bismuth gr. iij., Chlorate of Potash gr. ij.).

Sedative.

Pastillus Bismuthi et Morphiæ (Carbonate of Bismuth gr. iij., Acetate of Morphia gr. $\frac{1}{40}$).

INSUFFLATIONS.

(See also Snuffs.)

The general composition of powders for this purpose has already been described (*see* vol. i., p. 425). Most of those which are there mentioned are also available for the nasal passages and the naso-pharynx. The following are a few additional formulæ which I have found very useful. Where a vehicle is required for the medicinal agent, I generally prefer dried maize starch. Powdered myrrh and phosphate of lime are also occasionally serviceable in order to give bulk to the powder. The indications for use are clearly shown by the nature of the remedy. Two or more may sometimes be advantageously combined together, *e.g.*, a little acetate of morphia or bismuth may be added to catechu or eucalyptus if these powders are found too irritating:

Insufflatio Bismuthi Oxychloridi (gr. ¼—½).[1]
Insufflatio Aluminis Exsiccati (gr. ss.—j.).
Insufflatio Catechu Pallidi Pulverisati (gr. ¼—½).
Insufflatio Gummi Rubri (one part to two of dried maize starch).
Insufflatio Ferri Persulphatis (one part to three of dried maize starch).
Insufflatio Ferro-Aluminis (with an equal quantity of dried maize starch).
Insufflatio Iodoformi (gr. ¼—½, with an equal quantity of dried maize starch).

SNUFFS.

(See also Insufflations.)

These are chiefly useful for checking catarrh in its initial stage. They should be taken frequently, but not for more than forty-eight hours continuously.

℞. Morphiæ sulph. ..... gr. ij.
Bismuth. subcarb. ..... ʒj.
M. ft. pulv.

The following is the formula known as "Dr. Ferrier's Snuff,"[2] or—

Pulvis Bismuthi Compositus.

℞. Morphiæ hydrochlorat. ..... gr. ij.
Pulv. acaciæ ..... ʒij.
Bismuth. subnitrat. ..... ʒvj.
M. ft. pulv.

One-fourth to one-half may be used in twenty-four hours.

---

[1] This is a more impalpable and less irritating preparation than either the carbonate, subnitrate, or oxide of bismuth. It is also less soluble, which renders it more adapted to produce the mechanical effect of forming a coating over inflamed or raw mucous surfaces.

[2] Lancet, 1876, vol. i., p. 525.

The following snuff is recommended by Dobell[1] in chronic post-nasal catarrh:

℞. Camphor,
Tannic acid,
White sugar,
High-dried Welsh snuff.....āā 3j.
M. ft. pulv.

A pinch to be taken once in the morning and evening, and once or twice during the day. The snuff is to be discontinued if a fresh attack of nasal catarrh sets in, but should be resumed on the subsidence of inflammatory symptoms.

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[1] Op. cit., p. 211.

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